$4.00 per Year. OCTOBER 6, 1910 Price 10 Cents

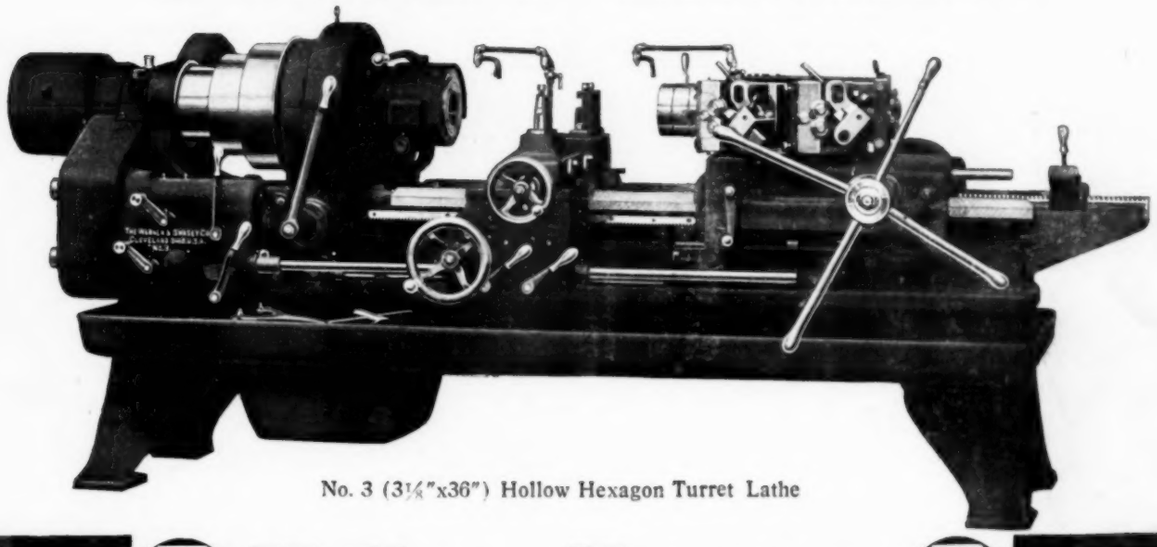
OCT 7 1910 PUBLIC LIBRARY

American Machinist

A Practical Journal of Machine Construction
Issued Weekly by the Hill Publishing Co., 505 Pearl St., New York

Vol. 33. Editorial Index Page 649 Advertising Index Page 69 No. 40

TURRET LATHES



No. 3 (3¼"x36") Hollow Hexagon Turret Lathe

Hollow Hexagon

are the most efficient machines on the market for Bar Stock or Forging work coming within their range. They are made in three sizes—

No. 1—Turns Diameters 1½ inches, Lengths, 18 inches
No. 2— " " 2¼ " " 24 "
No. 3— " " 3¼ " " 36 "

Some Of The Features:

Head and Bed cast together to insure strength and rigidity. Automatic Chuck and Power Roller Feed, operated by the same lever. Hexagon Turret providing the best possible tool supports for resisting all strains. Roller Back Rests on turning tools reducing friction to a minimum. Geared Automatic Feeds to Turret Slide providing quick changes. *Write for Catalogue.*

The Warner & Swasey Co.

Main Office and Factory: Cleveland, O., U. S. A.

New York: Singer Building Detroit: Ford Building
Chicago: Commercial National Bank Building

FOREIGN AGENTS: Chas. Churchill & Co., London, Birmingham, Manchester, Newcastle-on-Tyne and Glasgow. Schuchardt & Schutte, Berlin, Vienna, St. Petersburg, Stockholm. Alfred H. Schutte, Cologne, Paris, Brussels, Liege, Milan, Madrid, Bilbao, Barcelona. A. R. Williams Machinery Co., Toronto, Ont. Williams & Wilson, Montreal.

The P. & W. "High Power" Twisted Drill

(Patented, July 14, 1908)

The Strongest, Most Powerful And Longest-Lived Drill On The Market

FITS any standard taper socket—the kind you find in any machine shop. Fits any standard drillpress spindle without necessitating a special drive.

The increased twist forms a shank of exceptional holding power. It accurately centers the drill, keeps it in true alignment and makes it impossible to bend drill side-ways or twist shank under any drilling conditions.

The twisted shank is one size larger than usually supplied on other drills of same size and also without increasing price. The harder the service the firmer it grips the socket or spindle.

Can be driven at a greater feed and higher speed than any milled drill. Cheaper initially and in upkeep than a solid shank drill.

In all Standard Sizes

Machinists Small Tools and Gauges of all kinds.

Write for catalog "Small Tools" and "Standards and Gauges."

Pratt & Whitney Company

Hartford, Conn., U. S. A.

SALES OFFICES—New York, 111 Broadway. Boston: Oliver Bldg. Philadelphia: 21st and Callowhill Sts. Pittsburgh, Pa.: Frick Bldg. Cleveland: Rockefeller Bldg. Hamilton, O.: Niles Tool Works. Detroit: Majestic Bldg. Chicago: Commercial National Bank Bldg. St. Louis: 516 North Third St. Birmingham, Ala.: Brown-Marx Bldg. Agents for California, Nevada and Arizona: Parron, Rickard & McCone, 139 Townsend St., San Francisco, Cal., and 164-8 North Angeles St., Los Angeles, Cal.

Agents for Canada: The Canadian Fairbanks Co., Ltd., Montreal, St. John, Toronto, Winnipeg, Calgary and Vancouver. London, E. C.: Buck & Hickman, Ltd., 2 and 4 Whitechapel Road. London, S. W.: Niles-Bement-Pond Co., 23-25 Victoria St. Paris: Fenwick Freres & Co., 8 Rue de Rocroy, Agents for France, Belgium and Switzerland. Japan: F. W. Horne, 70-C Yokohama. Italy: Ing. Ercole Vaghi, Milan. Germany: F. G. Kretschmer & Co., Frankfurt a.M. Holland: Van Rietschoten & Houwens, West Zeedijk, 554, Rotterdam.

(*See page 66*)

PUBLIC LIBRARY,
No. 605 A5M
DETROIT, MICH.

The Knecht Rapid Production Planer

Special Correspondence

A planer with many novel feaures. The application of the power for the return stroke is independent of that used for the cutting stroke. The main driving pulley and belt run constantly in one direction only. Reversal of table is accomplished by means of gearing and without shock even at high speeds. The feed mechanism independent of the driving mechanism. Shifting mechanism controlled from either side.

In this planer, built by the Knecht Planer Company, Cincinnati, Ohio, and shown in Figs. 1 and 2, the power is transmitted from the first pulley to the table, through positive gearing. This first pulley runs constantly and in one direction only, with no limitations as to weight, speed or belt width. The illustrations show a cone pulley drive, but any other means of speed changing that substitutes the cone pulley are equally applicable. The novel feature, however, consists in the manner in which the reversing of the planer table is accomplished.

The object of the designer has been to produce a mode of driving in which the power used for the cutting stroke is independent of that used for the return movement of the table, not only for obtaining different cutting speeds and constant return, but also to avoid the reversal of the main driving pulley.

Upon first trial of this machine, it was found that there is practically no limit to the rate of speed of the return stroke, and no shock at the moment of reversal. The return speed of the trial machine was at the rate of 215 feet per minute, the limit being the safe peripheral speed of the gear teeth. This planer was not secured to the floor, and in this condition some of these machines may be seen in operation, finishing work at high speeds with satisfaction. However, as a conservative measure, the limit of return speed in the standard planer has been set at 150 feet per minute.

The cutting belt and cutting pulley run constantly and in one direction only, therefore, there is no limit to belt power, both as regards width and velocity. The planer shown in the illustration has a maximum belt-to-table ratio of 100 to 1, and a minimum belt-to-table ratio of 60 to 1, the drive being accomplished by a cone pulley and a back gear of the usual type employed in constantly running machine tools.

The reversing belt, placed on the left-hand side of the machine, shifts in the regular way, imparting the reverse motion to the planer table, but the reversing pulley, like the cutting pulley, runs in one direction only, and its width and speed are independent of the width and speed of the cutting pulley.

This reversing pulley is held by means of a ratchet-and-pawl mechanism during the cutting movement of the table, and released at the end of the cut, just previous to the moment when the reversing belt is shifted to the pulley. Furthermore, the reversing pulley starts at the moment it is released, so that the belt does not start it from rest. This relieves the motor of the starting and reversing strains, avoids high load peaks, and permits the use of a motor just large enough to do the work. For this reason the Knecht planers are equipped with motors much smaller than customary, notwithstanding the fact that they run at much higher speeds.

The power diagram, Figs. 3, 4 and 5, corroborate the facts stated as to power, as well as to efficiency. These diagrams were made with a Westinghouse recording amperemeter.

Fig. 3 is of a standard Knecht planer. As will be seen, the acceleration

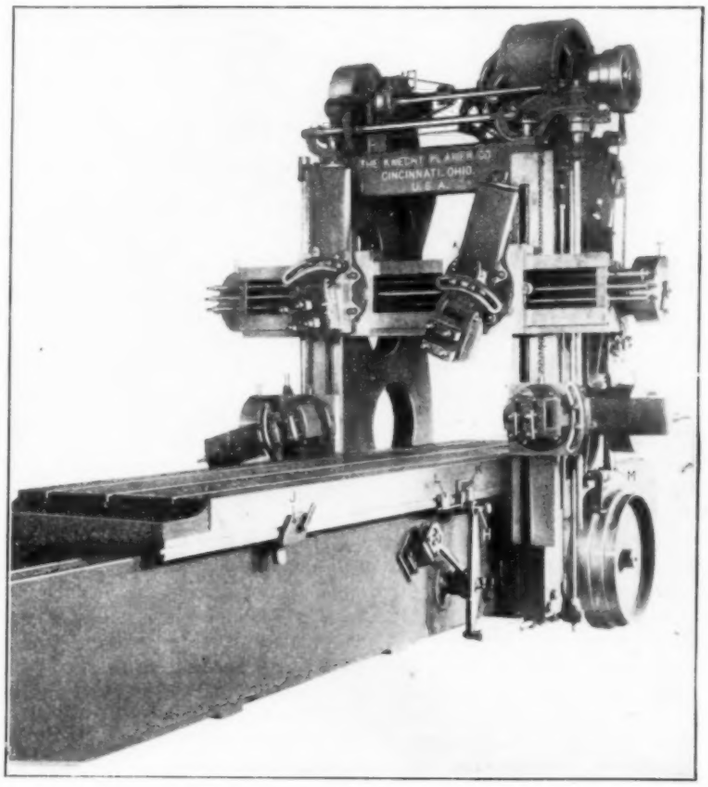


FIG. 1. A KNECHT PLANER SHOWING THE FOUR HEADS

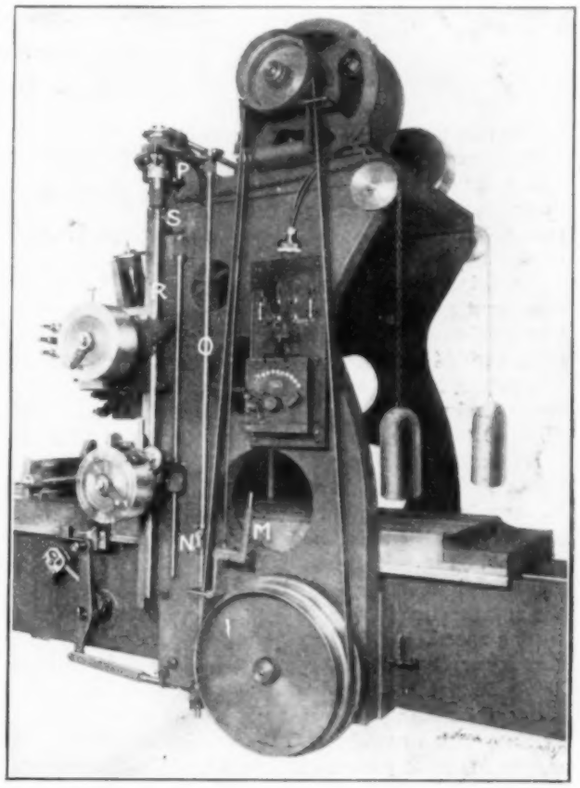


FIG. 2. KNECHT PLANER SHOWING SWITCHBOARD AND OPERATING MECHANISM

for the return stroke is only 40 amperes, and for the forward movement, there is a drop of power at the moment of reversal. It shows 25 amperes consumption at 135 feet per minute table speed, and only eight amperes at 30 feet per minute table speed.

Fig. 4 shows what takes place when changing the cutting speed without stopping the machine. In this instance the speed was changed at about the middle of the forward stroke. It will be noticed that when changing to a higher speed there is a small high peak, and when changing to a lower speed there is a drop of the needle, which seems reasonable.

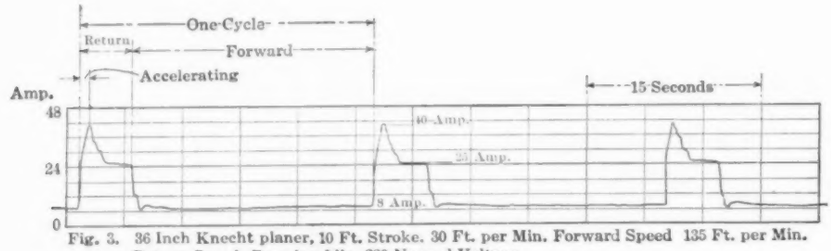


Fig. 3. 36 Inch Knecht planer, 10 Ft. Stroke. 30 Ft. per Min. Forward Speed 135 Ft. per Min. Return Speed. Running Idle. 220 Normal Voltage.

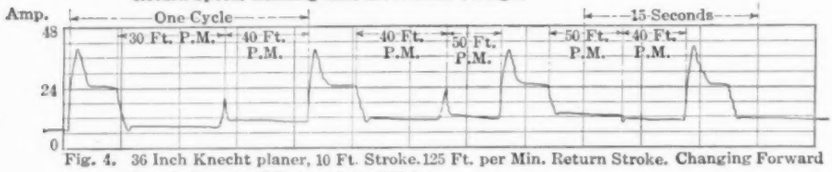


Fig. 4. 36 Inch Knecht planer, 10 Ft. Stroke. 125 Ft. per Min. Return Stroke. Changing Forward Speed. Running Idle 220 Normal Voltage.

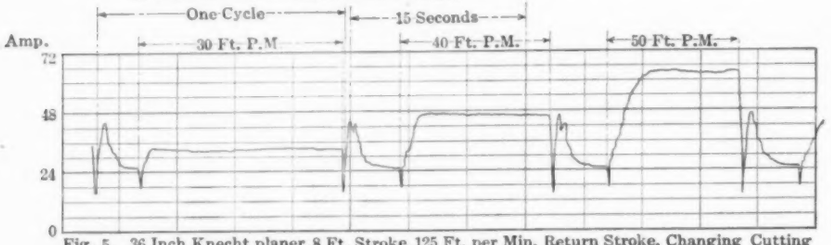


Fig. 5. 36 Inch Knecht planer, 8 Ft. Stroke. 125 Ft. per Min. Return Stroke. Changing Cutting Speed. 2 Tools ½ Inch Deep. ⅛ Inch Feed, on Cast Iron. 220 Normal Voltage.

American Machinist

DIAGRAMS OF POWER CONSUMPTION

Fig. 5 indicates the power consumption when cutting cast iron. Three consecutive strokes are shown, operating two tools, each ½ inch deep and ⅛ inch feed. The cutting speed was changed on the reverse stroke on each successive stroke, from 30 to 40 and 50 feet. The length of stroke is the same for the three strokes. The time consumed per cycle is seen in the diagram and is proportional to the length of each cycle on the diagram. The voltage shown is about 33 amperes, 46 amperes and 64 amperes for the cutting strokes at 30, 40 and 50 feet cutting speed. At 50 feet cutting speed, the power consumed for doing work is about 50 per cent. higher than the instantaneous high peak at the point of reversing, which corroborates the previous statements as to power. In Fig. 3 it will be noticed that the power consumption is remarkably low, which demonstrates the efficiency of the new driving mechanism.

In the designing of this machine, the pressure and lineal velocity of gear teeth have been carefully kept well under the allowance in good practice; the surface speed of journals under maximum pressure is kept low, and this pressure does not exceed much over 100 pounds per square inch of projected area in any instance. As a result of these conditions, the machine is insured of perfect lubrication, conducive to efficiency and long life.

A cone-pulley drive has been preferred to drive this planer because the range of cutting speeds on a planer is very small, say 2 or 3, and this fact produces a very small difference in the diameters of the driving cone on a planer. Furthermore, the convenience for changing speeds instantly and without stopping the machine, and other economical points of the cone drive as applied to the Knecht planer, gives this the advantage over any other speed-change device.

The motors as applied to this planer are rated by the maximum cut the machine will take, and are ample for taking care of the reversals at high speed. As for working efficiency, a representative of this paper has been shown some large gages used for tables and bed, which are required to be very true and which are neither ground nor scraped; these pieces demonstrate that very high grade of finishing is done on the Knecht planer.

The feed mechanism is positive and independent of the driving mechanism, and is driven by means of an independent pulley, with belt power just enough to move the slides to avoid breakage should two slides come together. The feed is operated in connection with the shifting mechanism and is actuated by a clutch which is tripped at either end of the stroke. The motion is transmitted by feed boxes, placed on either end of the cross rail and on each side head, making the machine a right- and left-hand machine throughout. If the operator is working with the left-hand side head, he can control the feed on the rail as well as the shifting mechanism, all from the left-hand side of the machine.

The action of feeding takes place exactly at the instant of reversing; this makes it unnecessary to allow the tool to run out of the work a long distance in order to give time for feeding.

Fig. 6 is an inverted plan of the bed showing the driving train of gears. *A* and *B* are two independent shafts. *A* transmits its motion through the gear *C*, and *B* transmits its motion through one of the gears *D*, gears *D* being slidable, giving two rates of motion therefrom.

The gear *C*, and one of the gears *D*, transmit their motion to the two large bevel gears which run free on the second driving shaft. These large bevel gears are connected by planetary pinions running on studs fast to a revolving frame. The revolving frame is keyed to the second driving shaft, and so is the small spur pinion, seen on one end of the shaft, which is driving the third shaft where the bull-wheel pinion is seen. The second driving shaft, with the frame keyed on, is a relatively slow-running member, and is the first member of the driving train which reverses its direction of rotation. The large bevel gears, running loose on the second driving shaft, and carrying on their hubs the spur gears seen alongside of them, do not reverse.

The shaft *B* carries the three-step cone pulley, which, in combination with the sliding gears *D*, transmit six different speeds to the large bevel gear on the driving side.

The shaft *A* carries a tight and a loose pulley. The tight pulley is provided with ratchet-and-pawl mechanism which arrests this pulley when the belt is shifted to the loose pulley.

The hand lever *E* and the knob *F* are used for sliding gears *D*. The combination of these two parts makes an effective and simple interlocking device. The hand lever *E* slides the gears *D* one at a time, and will bring into mesh only one of them, depending on the in or out position of the knob *F*. On the other hand, the knob *F* cannot be moved when one of the gears *D* is in mesh.

The shaft *B* is running constantly and drives one large bevel gear through one of the pinions *D* and its mating gear.

The shaft *A*, controlled by a tight pulpulley, has three conditions which correspond to the three positions of the shifter handle *H*, Fig. 1. With the handle *H* in central position, the tight pulley and shaft *A* are free to turn, and the motion of the shaft *B* is transmitted around the bevel gears which keeps this shaft *A* in motion; the planer table standing still. With the handle *H* to the left, the tight pulley is arrested by the ratchet-and-pawl mechanism as is also the shaft *A*, the pinion *C*, and one large bevel gear. In this condition, the table advances in its forward stroke, there being no differential action for this cutting stroke. With the handle *H* moved to the right-side position, the tight pulley is acted upon by its reversing belt. In this condition, the planer table is reversed by the differential motion.

The shifter lever is operated by the dogs *J K*, Fig. 1. The dog *K* is automatic in its action; it can be moved along by the handle *L*, but on releasing the handle, it is automatically clamped. The handle *M* shifts the cutting belt for changing speeds without stopping the machine. On Fig. 2 the belt is seen on the middle step, with the shifting mechanism plainly shown.

The shaft *O* is the feed trip shaft; the shifting mechanism trips this shaft and operates the clutch *P* which drives the feed shaft *R*. This clutch is much like a punch-press clutch. By this means,

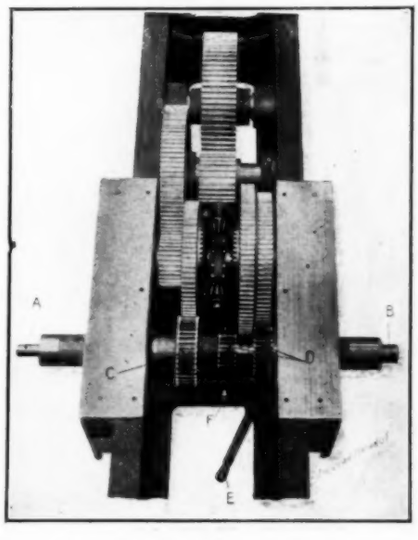


FIG. 6. THE DRIVING TRAIN

the shaft *R* makes one turn every time the clutch is tripped, which may be set for either end of the stroke. The crank handle *N*, directly in connection with the trip shaft *O*, may be used for cutting off the feed trip, as by turning this handle, the shaft *O* is set out of the way of the shifting mechanism. The bevel gears *S*, when connected, transmit the feed motion to the left-hand side of the machine for the left-hand feed control.

Figs. 1 and 2 show also the side heads, which can be put in place or removed in half an hour's time each. The complete side-head unit is simply slid on the face of the housing from underneath, and the side-head lead-screw bearing is bolted on, without disturbing any parts, nor adding any feed parts. The shaft *R* connects with the feed box on the end of the rail and the feed box on the side head by the bevel gears *S*, Fig. 2. Another vertical shaft on the left side of machine connects in same manner when the left-hand feed control is provided.

Fig. 7 shows the feed box on the end of the rail and its connection to feed screws and feed rod. The feed motion is delivered from the feed box to either screw or rod in the rail by means of two gears that run in opposite directions, and hand sliding pinions between these gears, as can be clearly seen. This mechanism affords an independent reverse of feed motion, very simple and convenient. *U* is the controlling handle for the amount

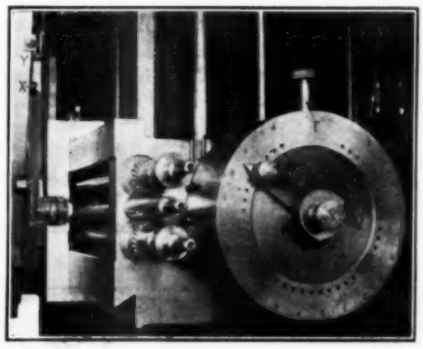


FIG. 7. FEED BOX ON END OF RAIL

of feed, there being feeds from 1/64 inch to ¾ inch, increasing by sixty-fourths.

T is the *off* and *on* handle. By means of this handle the feed in the individual feed box is stopped and started, without disturbing the setting, in amount or direction.

V is the *quick-traverse* handle. By pulling out this handle, a fast and continuous running motion is transmitted to the slide that is connected for feeding, for quickly withdrawing it. This handle *V* snaps in by spring pressure, as soon as the hand is released therefrom.

The continuous quick motion for the saddles and slides is found very useful when setting and testing work, or whenever it is necessary to slide the saddles the full length of the rail, especially when these parts are heavy and also when the advantage of keeping the sliding gibs adjusted snugly is appreciated. For this purpose, the shaft *O* is operated by the crank handle *N*, Fig. 2. This brings the shaft *O* out of the way of the shifting mechanism and keeps the clutch *P* opened, which produces continuous running motion on the feed shafts *R*. In this condition, the handle *T* being in the *off* position, the saddles and slides are under the direct control of the handle *V* for quick motion, and of the hand-sliding pinions for direction of motion.

X is a nurled head for taking up slack motion on the vertical slide screw; it is also used for clamping the screw in ad-

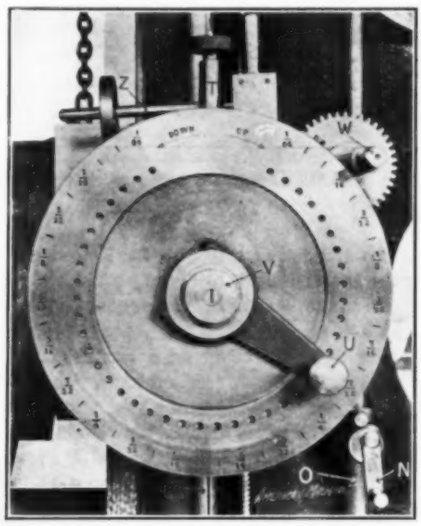


FIG. 8. FEED BOX ON SIDE HEAD

dition to the ordinary means provided for clamping the vertical slides. *Y* is a micro-stop for depth gaging, with which the slides are provided.

A micrometer dial, of extraordinary dimensions and very conveniently read, will be seen on the vertical-slide screw. Micrometer dials will also be seen on ends of the rail screws.

The tool blocks afford four clamping bolts for any imaginable position of the tool.

On the end of the rail screws and rail rod, the usual square heads are provided for ordinary hand motion, which can be applied at any time without disconnecting or disturbing anything. The sliding pinions and mating gears are nominally out of engagement with the feed-box mechanism, this engagement taking place only at the instant of feeding.

Fig. 8 shows the same feed-box unit (as shown in Fig. 7) applied to a side head, the same reference letters being used for similar parts, excepting the rod *Z*, which is used for reversing the feed in place of the hand-sliding pinions. The amount of feed determined by the position of the handle *U* depends on whether the reading is followed on the scale marked with the arrow down, or on the scale marked with the arrow up. This reading is done so as to coincide with the up or down position of the rod *Z*. This rod is provided with a vertical handle and is marked with arrows that correspond to the arrows on the feed box. The disk seen on the rod *Z* automatically

FIG. 9. COVER OF FEED BOX

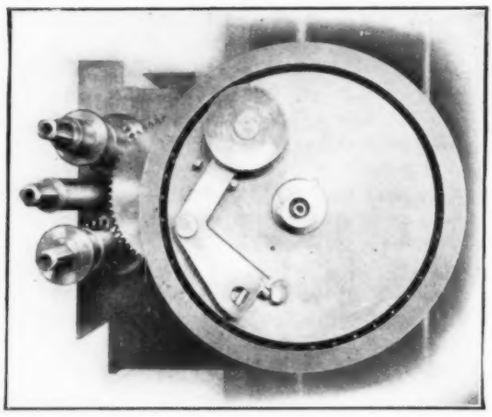


FIG. 10. FEED BOX WITH COVER REMOVED

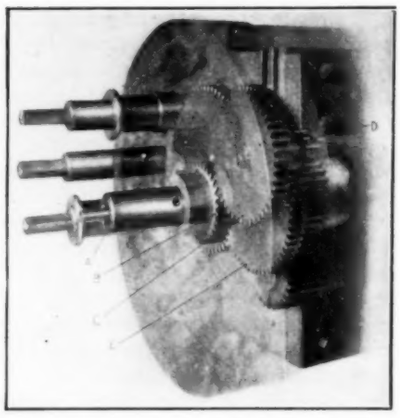


FIG. 11. FEED BOX WITH SOLID DISK REMOVED

stops the head on its vertical movement near the crossrail, to avoid breakage. *W* is a square end for the crank-hand motion.

Fig 9 is the cover of a feed box.. It carries with it the feed-*on* and *off* handle *T*, and the feed-controlling handle *U* on front side. The central hub and cam move around with the handle *U*, their position depending on the position of the handle *U* on the feed dial. *T* in the position shown is *off* and there will be no feed; when projected inwardly, it starts the feed and the central cam cuts the feed off, the amount depending on the position of the cam.

Fig. 10 is the same feed box on the end of the crossrail as shown in Fig. 7, with the cover removed. The roller seen on end of bell crank comes in contact with the two interfering elements on the feed-box cover, as shown on Fig. 9, that is, the throw-in handle *T* and cutting-off cam, set by the handle *U*. The bell crank is pivoted on the face of a solid disk and carries a sliding pin on one end. This pin slides radially in a radial hole in the solid disk. The solid disk is surrounded by a hollow disk, the inner surface of which carries projecting pins, clearly seen. The solid disk is the driver and the hollow disk is the driven element. The radial pin in the solid disk is the intermittent connection for transmitting the feed motion, which connection takes place only at the instant of feeding. The solid disk is directly geared, one to one, with the feed shaft *R*, and makes one complete turn every time the feed clutch *P* is tripped. The roller on the bell crank strikes the projection of the handle *T* in the feed-box cover and then the cutting-off cam, throwing the sliding pin in the solid disk in and out of engagement with the hollow disk, which is directly geared to the feed screws in the cross rail. The spacing of the projecting pins on the inner surface of the hollow disk has a fixed relation with the spacing of the holes seen on the outside of the feed-box cover, which control the position of the handle *U* and the cutting-off cam.

Fig. 11 shows the solid disk removed, the hollow disk transparent, so that the train of gears can be seen. The shaft *A* is the driver, which makes one turn and stops. The gear *B* is keyed on shaft *A* and carries on its hub, seen with a key, the solid disk which has been removed. The gears *C* and *D* are keyed on same shaft and this shaft runs in a hole drilled through the inner wall of the hollow disk. This hollow disk runs free on the shaft *A*. The gear *E* runs free on the shaft *A*, and is the final driven element on feed box, being directly geared to the rail screws. The amount of motion of gear *E* is directly proportional to the amount of feed motion transmitted, consequently, the feed-box mechanism ends on this gear *E*.

It will be apparent that the pinion *D* may drive the gear *E*, or simply roll around without imparting any motion

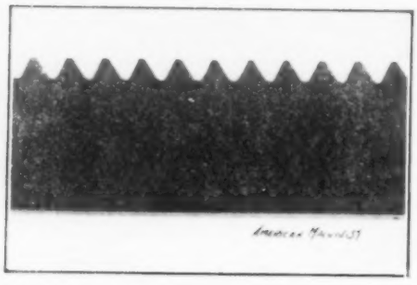


FIG. 12. REPRODUCED FROM RACK CUT WITH REGULAR FEED

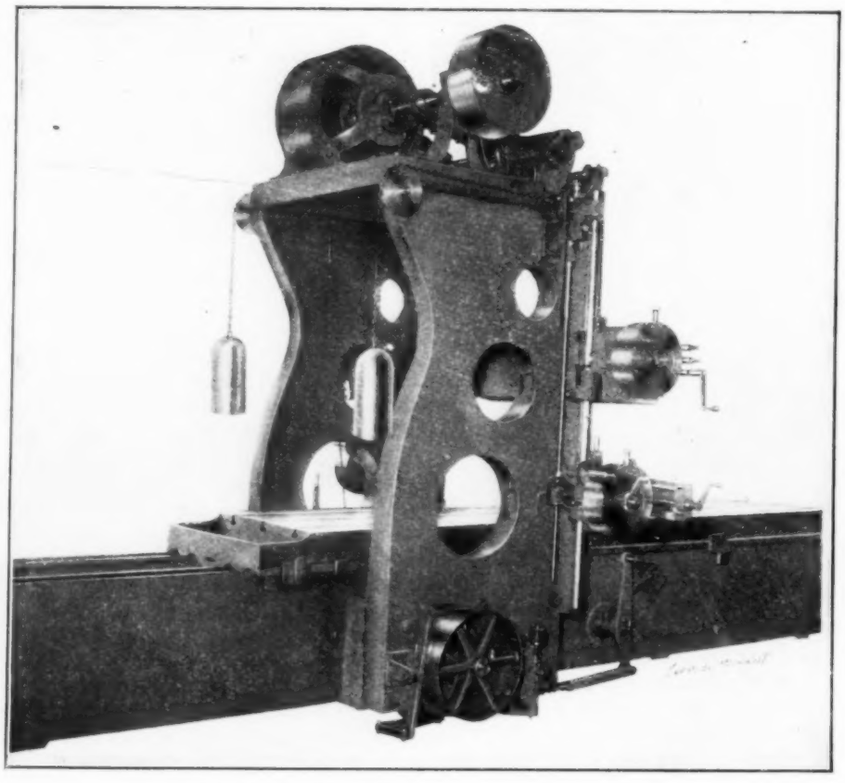


FIG. 13. LEFT SIDE VIEW OF KNECHT PLANER

to the gear *E*, depending on whether the hollow disk is free or whether it is locked with the solid disk in the manner explained above. During the time that this locking connection takes place both disks turn together, and the pinion *D* takes with it the gear *E;* before or after the intermittent connection takes place, the pinion *B* and solid disk turn idly, the pinion *B* drives the gear *C* and the pinion *D* rolls around the gear *E*. By this planetary action, the hollow disk turns free on its shafts. The amount of idle motion of the hollow disk is a submultiple of the amount of idle motion of the solid disk. The amount of active motion of these two disks is equal and depends, as explained before, on the spacing of the operating pins and index holes. By these means, the intermittent connecting parts, though independent of one another when disconnected, are actually geared together by positive gears and their subsequent actions are definitely timed. As a result, the radially sliding pin in the solid disk falls in between two projecting pins of the hollow disk without ever striking the pins and without ever missing. When hand motion is applied to the feed screws or rods, the gear *E* turns, the pinion *D* turns, the gear *C* rolls around the pinion *B*, and the hollow disk turns freely, but as soon as the first feed-trip takes place, these intermittent connecting parts assume again their proper relative positions.

This kind of gearing starts and stops without jar and advantageously substitutes the crank-starting motion.

The rod *V* is kept in by spring pressure; when pulled out, it clutches the gear *E* to the shaft *A* and forms the means for starting and stopping the quick traverse motion when the crank handle *N*, Fig. 2, has been so positioned that the vertical feed shaft *R* and the shaft *A* are running. To demonstrate the accuracy of this feeding mechanism, it is only necessary to place a regular chasing tool for operation on this planer and produce an accurate rack. A reproduction from one of these racks is shown in Fig. 12. This rack was produced by several cuts going the full length of same, with forward and reverse feed, and each time the tool followed the same path.

Fig. 13 is a left-side view of the 36-inch by 36-inch by 12-foot Knecht right- and left-hand planer. The machine is self-contained, and the massive upper cross-tie piece between housings is provided for motor as well as for belt-driven machines. A complete countershaft takes the place of the motor and shaft shown. The conversion of the one type of drive into the other is a simple proposition. The table is of extra thickness, with planed T-slots and dowel-pin holes. The table width takes in all the room between the housings except two inches, making an exceptionally wide table, increasing the distance between Vs, and decreasing the overhang of the sides. To aid in rigidity, all running parts are carefully balanced, for dynamic balance, the result being the absence of vibration, to which end much study has been given.

The accessibility to all operating levers, from the operator's place, is striking.

Fig. 13 shows all the parts for left-hand control. The chains are for counterweighting the side heads. They may be run through holes in the floor, or the weights themselves may be left above the floor, there being room provided for this behind the housings. The oiling system has been given special attention. The V's are constantly overflowed with oil, the oil pockets are connected by internal return pipes, and the bed is provided with outside wiper-pockets, for cleanliness and economy.

Making Locomotive Piston Rings

The methods of making Dunbar piston rings at the Beech Grove shops of the Big Four Railroad are shown in the accompanying illustrations.

Taking the tub or pot from the rough, it is first chucked and rough finished, both inside and out, with an allowance of 3/32 inch for finishing. The grooves shown in Fig. 1 are then cut with an allowance of 1/32 inch for finish. The side tool *A* has a point 1/8 inch thick, while behind this it has a 3/8-inch step. This tool finishes the under side of the ring, the point being fed in 1/32 inch deeper than the finished inside diameter of the ring being turned.

Editorial Correspondence

An efficient method of making double packing on the boring mill, clearly showing the three operations of under cutting the grooves, finishing the L surfaces and finishing both rings.

In Fig. 2 are the side tools which are used to finish the surfaces marked *L*. After this is finished, the plain ring or case is then forced on the *L* ring, as can be seen in Fig. 3.

The tool head at the right carries three tools, each being shown finishing the top surface of the tool rings together and *D* finishing the outside surfaces in the same way. At the same time tool *C* in the other head is finishing the inside surface of the *L* ring, and when it reaches the groove made by the point of the tool *A*, in Fig. 1, the tool rings are cut off and put away completed while still together, as they are then ready to be sawed. Tool *F* is a double chamfering tool for finishing the edges of the rings, both above and below the groove.

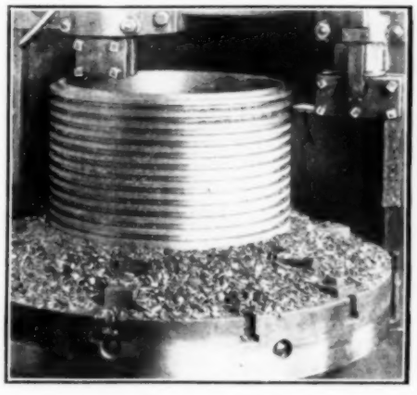


FIG. 1. UNDER CUTTING THE GROOVES

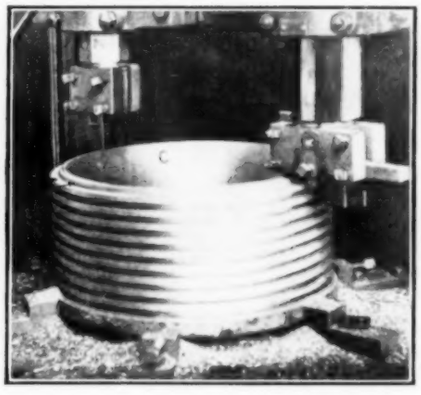


FIG. 2. FINISHING THE L SURFACES

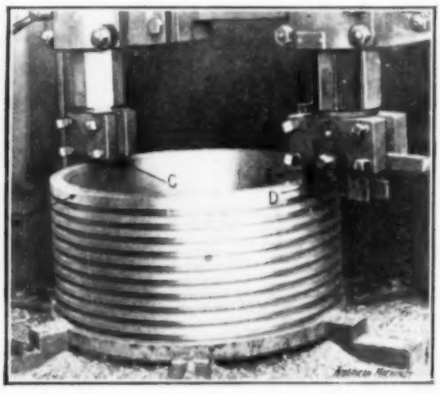


FIG. 3. FINISHING BOTH RINGS

Electric Arc Welding

By F. Scott Anderson

The advance in favor of electric arc welding and kinds of work it has been applied to. Portable plants.

Series of tests showing the efficiency of welds on iron and steel as compared with the original metal and with hand welds made with the forge fire.

The kind of electrodes and precautions necessary to prevent burns, etc. Absence of danger from shocks.

Electric arc welding is gaining favor in its various forms of single arc, double arc, carbon electrode, iron electrode, etc., and it has been applied to many difficult kinds of work.

Steamship repairs, such as pitted boiler plates, defective boiler plates, plates worn thin by various causes, crank-shaft repairs, propeller-shaft repairs, stern-post repairs and all other breakages of iron or steel parts in steamship equipments, are being welded electrically with the greatest satisfaction.

Portable Welding Plants

In one English shipyard a portable plant is carried about on an electrically driven trolley. The generator is wound for a low voltage supply, and the main cables are carried to any required spot, whether in the yard or the boiler room of a ship. The voltage of the main supply being 500, a motor generator gives the necessary e.m.f. In another case the plant is installed on board a barge, the generator being driven by an oil engine.

For making good the defects of breakages in cast iron and steel in England, electric welding has gained greatly in favor, and a very large number of plants are in daily use. The welds are made with an electrode of special iron which insures perfectly soft and toolable welds. No complaints of any kind are now heard of hard welds.

Steel barrel, drums and tanks of all kinds, as well as steel boat hulls, are being put together with electric welds. Steel flanges are welded to steel tubes, and steel tubes, boiler flues and cylinders, from 8 to 20 inches in diameter and from 3 to 23 feet long, with a thickness varying from ¼ to 2 inches have been most successfully welded and passed the usual tests.

Quality of the Work

In order that the capabilities of the electric arc welding, as regards the quality of work, might be placed beyond doubt, 210 bars of varying thicknesses and qualities, of iron and steel, were electrically heated and welded by ordinary workmen and 50 bars were welded by enginesmiths in a coke fire, and at another firm's shop.

The bars were then tested and the results will be found in Tables 1 and 2. The average efficiency of the electric welds to the original stock, of the 150 iron bars, equaled 85.5 per cent. and the 60 steel bars averaged 80.8 per cent.

A comparison between the results obtained from the hand- and electrically welded bars will show that in every case the latter gave a higher efficiency than the former. In other respects, also, the comparison is usually favorable to the electrically welded bars.

Welds Scarfed and Hammered

These experiments are believed to be the first attempt to demonstrate scientifically the value of the electric arc as a heater of iron and steel for welding purposes. The results shown were obtained by comparatively unskilled hands, and could be materially improved by continuous practice.

The welds were scarf welds, with a length of scarf averaging from 1¼ to 1½ inches. The principal features were the absence of cinder or impurities in the faces of the scarf; the maintenance of a fair amount of ductility at the weld, and the material not being abnormally affected by the heating.

Where the welds show low figures, the appearance of the fracture would indicate

Material and Brand.	Nominal Size.	Description.	Ultimate Stress per Square Inch.	Contraction of Area at Fracture.	Extension in 10 Inches.	Ratio of Weld to Solid.
	Inches.		Tons.	Per Cent.	Per Cent.	Per Cent.
Iron, Low Moor	2 × ⅞	mean of solid	26.1	42.3	19.5	....
Iron, Low Moor	2 × ⅞	mean of welds	21.1	17.3	7.3	81.1
Iron, Low Moor	2 × 1	mean of solid	24.8	45.7	22.9	....
Iron, Low Moor	2 × 1	mean of welds	21.6	20.9	8.1	87.2
Iron, Low Moor	2 × ⅞	mean of solid	23.8	46.0	24.1	....
Iron, Low Moor	2 × ⅞	mean of welds	21.8	20.7	9.7	91.8
Iron, Low Moor	2 × ¾	mean of solid	24.7	41.7	26.7	....
Iron, Low Moor	2 × ¾	mean of welds	22.1	16.7	9.0	89.4
Iron, Low Moor	2 × ½	mean of solid	21.4	46.9	31.3	....
Iron, Low Moor	2 × ½	mean of welds	20.7	19.2	10.2	96.8
Iron, Farnley	2 × ½	mean of solid	24.1	31.2	17.3	....
Iron, Farnley	2 × ½	mean of welds	20.7	6.5	4.4	85.8
Iron, Farnley	2 × ⅞	mean of solid	26.4	37.4	18.1	....
Iron, Farnley	2 × ⅞	mean of welds	20.5	8.6	4.4	77.5
Iron, Farnley	2 × 1	mean of solid	23.6	35.7	23.3	....
Iron, Farnley	2 × 1	mean of welds	21.6	17.6	6.5	91.6
Iron, Farnley	2 × ¾	mean of solid	21.9	49.4	27.5	....
Iron, Farnley	2 × ¾	mean of welds	21.5	13.1	6.4	98.4
Iron, Farnley	2 × ½	mean of solid	21.9	44.7	26.7	....
Iron, Farnley	2 × ½	mean of welds	18.9	10.5	4.6	86.4
Iron, Netherton, best	2 × ⅞	mean of solid	23.2	23.5	11.2	....
Iron, Netherton, best	2 × ⅞	mean of welds	19.7	8.6	4.7	85.0
Iron, Netherton, best	2 × 1	mean of solid	21.8	22.7	10.6	....
Iron, Netherton, best	2 × 1	mean of welds	20.1	10.8	4.5	92.0
Iron, Netherton, best	2 × ⅞	mean of solid	25.1	23.7	18.0	....
Iron, Netherton, best	2 × ⅞	mean of welds	18.2	7.0	2.2	72.4
Iron, Netherton, best	2 × ¾	mean of solid	25.1	24.3	20.9	....
Iron, Netherton, best	2 × ¾	mean of welds	18.3	5.8	2.5	72.9
Iron, Netherton, best	2 × ½	mean of solid	23.9	29.5	23.2	....
Iron, Netherton, best	2 × ½	mean of welds	18.5	5.5	3.4	77.7
Steel, Parkgate, Yorkshire	2 × ¼	mean of solid	30.3	57.1	22.3	....
Steel, Parkgate, Yorkshire	2 × ¼	mean of welds	22.3	18.4	3.8	73.6
Steel, Parkgate, Yorkshire	2 × ⅞	mean of solid	25.6	57.2	25.7	....
Steel, Parkgate, Yorkshire	2 × ⅞	mean of welds	20.8	16.0	4.2	81.2
Steel, Parkgate, Yorkshire	2 × ¼	mean of solid	25.3	57.4	27.0	....
Steel, Parkgate, Yorkshire	2 × ¼	mean of welds	19.8	17.5	4.4	78.4
Steel, Parkgate, Yorkshire	2 × ⅝	mean of solid	24.5	57.1	26.4	....
Steel, Parkgate, Yorkshire	2 × ⅝	mean of welds	20.7	17.1	6.1	84.7
Steel, Parkgate, Yorkshire	2 × ½	mean of solid	25.0	54.7	26.0	....
Steel, Parkgate, Yorkshire	2 × ½	mean of welds	20.1	15.5	6.3	80.5
Steel, Parkgate, Yorkshire	2 × ½	mean of solid	24.3	61.2	31.5	....
Steel, Parkgate, Yorkshire	2 × ½	mean of welds	21.0	15.4	7.3	86.4

TABLE 1.—SUMMARY OF RESULTS OF TESTS GIVEN ELECTRICALLY-WELDED BARS OF IRON AND STEEL.

Nota Bene.—The mean results are based upon ten welds, as far as the ultimate stress per square inch and the efficiency of welds is concerned. But as regards the contraction of area and the extension, those results are the mean of the welds which broke (of necessity, where the weld did not break, the contraction or ultimate extension was not obtained).

that the metal had not been hot enough, or the thin edge of the scarf had cooled before the weld was closed by hammering.

In the case of the Netherton iron, there is a serious tendency toward loss of ductility; the fractures being crystalline. Thus, it would appear that the treatment had not been adapted to the nature of the iron.

The mean of electrically heated welds was 18.5 per cent., better in figure of merit than the mean of the hand-made welds.

Material and Brand.	Nominal Size, Inches.	Ultimate Strain per Square Inch, Tons.	Contraction of Area at Fracture.	Extension in 10 Inches.	Ratio of Weld to Solid.	Figure of Merit: Ultimate Strain Multiplied by Contraction of Area at Fracture.
Iron, Low Moor	2 x 5/16	20.3	15.2	7.3	77.9	308
Iron, Low Moor	2 x 5/16	21.1	17.3	7.3	81.1	365*
Iron, Low Moor	2 x 5/16	21.5	22.3	11.3	90.7	479
Iron, Low Moor	2 x 5/16	21.8*	20.7*	9.7*	91.8*	451*
Iron, Netherton, best	2 x 1/4	18.4	10.1	3.4	84.4	185
Iron, Netherton, best	2 x 1/4	20.1*	10.8*	4.5*	92.0*	217*
Steel, Parkgate	2 x 1/4	20.9	9.3	1.9	69.1	194
Steel, Parkgate	2 x 1/4	22.3*	18.4*	3.8*	73.6*	410*
Steel, Parkgate	2 x 1/4	20.4	15.9	8.1	82.3	324
Steel, Parkgate	2 x 1/4	21.0*	15.4*	7.3*	86.4*	323*
					118.5 per cent.	1.766* / 1.490

TABLE 2. COMPARISON OF TESTS GIVEN THE ELECTRICAL AND HAND WELDS.

NOTE—* Indicates results of electrical welds given in Table 1.

ESSENTIAL DETAILS

The most essential points in welding are, unquestionably, proper voltage and suitable electrodes. Where a carbon electrode is employed, it should be mixed with a suitable flux to insure a softness of metal at the weld. Without this no arc welding can be satisfactory.

The face and eyes of the workmen must in all cases be protected. That portion of the protector covering the eyes should be ruby-colored glass; preferably in three separate thicknesses. If the eyes are exposed even momentarily to the glare of a large arc, an effect is produced upon their muscles which, though not permanently injurious or of more than a few hours' duration, is very painful and disagreeable while it lasts.

The effect produced upon the face or other tender portions of the skin by exposure to the radiant energy of the arc for any length of time is similar to that produced by very severe sunburn, and becomes painful when an attempt is made to wash the parts with soap; hence, any part of the skin should never be exposed to the arc.

When these precautions are taken, no trouble has ever been experienced, and the workmen are now welding, who have been associated with the process since its introduction.

With a current of such low tension as is used in welding, it is impossible to get a dangerous, or even unpleasant shock. The machine or articles in circuit may consequently be handled with impunity, and all the operations of welding can be carried on with the workmen sitting, or even lying, upon the work being welded.

In a great many welding operations, such, for instance, as the repairing of a leaky boiler plate, it is absolutely necessary to lower the temperature of the arc, in order to prevent the burning of the metal. This can only be done by the use of a special electrode, and its selection can be made after long experience of the individual requirements.

Calculations for Hobbing Gears

Editorial Correspondence

A handy table and a rule that will allow very close estimating for hobbing speed and time.

The hobbing of gears has not yet become common enough to have it as familiar to operators and others as the older methods, so that the following data on estimating the time for the work to be done, prepared from information furnished by the Adams Company, of Dubuque, Ia., will be found very convenient.

It is clear that with a 60-tooth gear the hob must make 60 revolutions to each revolution of the gear blank when the hob has a single thread. This is exactly the same as a worm and worm wheel. If the hob has a double thread it will only need to make 30 revolutions per revolution of the gear blank.

At each revolution of the gear blank the hob feeds a certain distance across the face of the gear, so that, by multiplying the number of revolutions of the gear blank by the feed per revolution, the feed per minute can be obtained.

The table gives the feeds which have been found advisable for different metals as well as the best speed of the hob for the different pitches of teeth.

In other words, the revolutions per minute of the hob is to the number of revolutions of the gear blank as the number of teeth in the gear is to the number of threads in the hob. From the point of view of speed the multiple-threaded hob is most desirable, especially for large gears of fine pitch. A single-threaded hob is apt to be more accurate and is recommended for the best quality of gears. Dividing the diametral pitch by 5 gives the greatest number of threads permissible on a hob of from 3 to 3½ inches in diameter.

Material	Pitch	Revs. of Hob per Minute	Feed per Rev. of Blank	Number of Thds. on Hob.
Cast iron	3	65	0.03″	1
Cast iron	4	65	0.032″	1
Cast iron	5	85	0.035″	1
Cast iron	6	100	0.05″	1
Cast iron	8	114	0.068″	1
Cast iron	16	114	0.1″	1
Nickel steel	6	75	0.02″	1
Carbon steel	6	90	0.035″	1
Mild steel	10	95	0.05″	1
Bronze	16	175	0.1″	2
Bronze	32	225	0.1″	4–5
Bronze	50	250	0.1″	9

TABLE OF HOBBING SPEEDS AND FEEDS.

A handy formula is

$$\text{Feed per minute} = \frac{F\,S\,T}{N}$$

when

F = Feed per revolution of blank;
S = Revolutions per minute of hob;
T = Number of threads on hob;
N = Number of teeth in gear.

Transposing this formula to $\frac{N}{F\,S\,T} =$ minutes per inch of feed, is a little more convenient in most cases. Taking a 60-tooth cast-iron gear, 8 pitch, single-threaded hob. $\frac{60}{114 \times .068} = \frac{60}{7.752} = 7.7$ minutes per inch of face.

Or to find the feed per minute with this same gear we have $\frac{.068 \times 114 \times 1}{60} = .129$ inch per minute.

Special Automobile Tool Equipment

By T. A. Sperry

Special tool equipments for Gisholt and engine lathes used in the Marmon shop.

Machining double transmission gears from 5½-inch vanadium steel bar stock.

Turning pistons on a 20-inch lathe. A hand reaming stand for crank cases. Floating taps.

The automobile building industry is certainly "going some" these days, and the builders are sparing no pains or expense to constantly improve the quality and excellence of their machines, and at the same time reduce their cost. The automobile has been responsible for tremendous improvements in the quality and standards of materials, especially of steels of various classes, and it is now exerting the same influence on machine-shop practices and standards, so that today it is possible to buy as good a machine for a thousand dollars as a few years ago could have been bought for three times that amount, while a twenty-five hundred dollar machine today is a better machine than could have been had then at any price.

One of the cars that is helping to make and maintain these high standards is the Marmon, some of the methods employed in the building of which were recently illustrated in the AMERICAN MACHINIST.

The cuts herewith will illustrate a few more of these methods, and show the degree of specialization to which the work is carried, and the accuracy of duplication and exactness demanded.

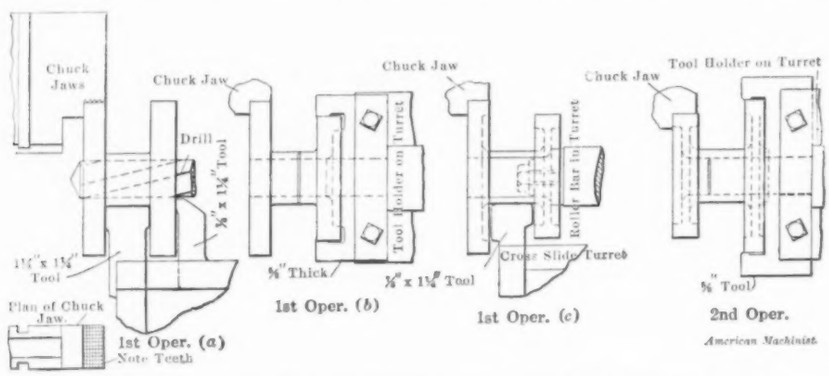


FIG. 1. TOOL OUTFIT FOR 24-INCH GISHOLT FOR DOUBLE TRANSMISSION GEAR

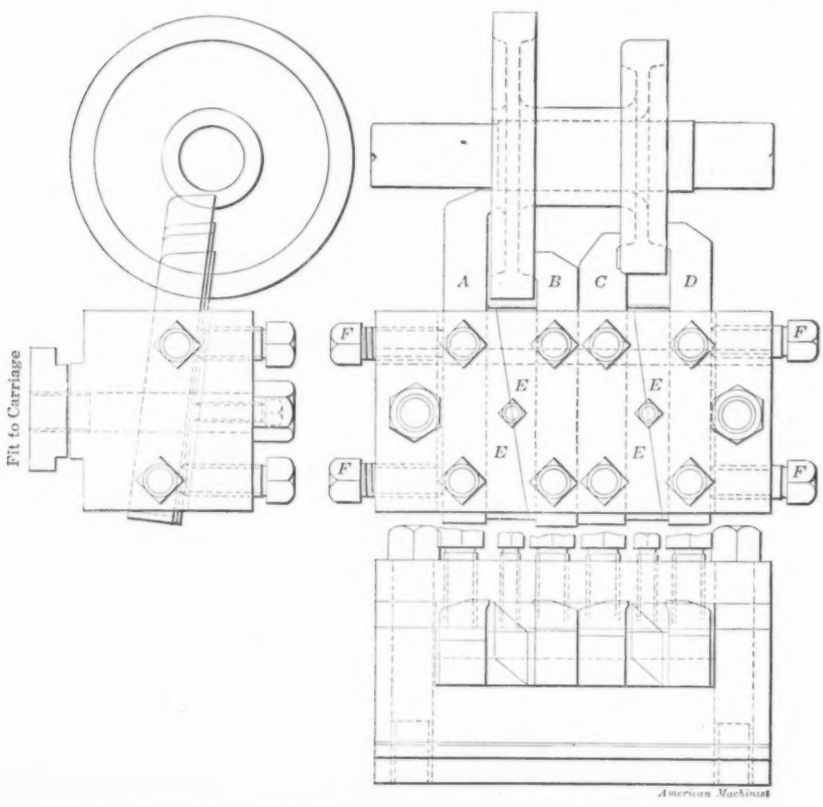


FIG. 2. 20-INCH ENGINE LATHE OUTFIT FOR DOUBLE TRANSMISSION GEAR

The cuts herewith will illustrate a few more of these methods, and show the degree of specialization to which the work is carried, and the accuracy of duplication and exactness demanded.

Fig. 1 shows a tool outfit for a 24-inch Gisholt lathe for machining the double transmission gear. These gears are made from a solid bar of vanadium steel, 5½ inches diameter, sawed to the proper length of 3 5/16 inches. The bar is chucked in special jaws; a drill, held in the turret, is started cutting and at the same time the two special tools in the cross-feed turret head rough off one end and form out the center recess (Oper. 1-a.). Both of these tools are made with a heavy side and back rake and small clearance in order to avoid chatter. The hole is then reamed and the special forming tool, with pilot, is brought into operation by the turret, and reduces the smaller gear nearly to diameter and at the same time recesses and cuts the radius in the face of this gear (Oper. 1-b.). The turret is then revolved and a pressure roller is brought to bear in the hole while the double-edge tool in the cross-slide turret head forms the recess on the two inside faces of the gears, first on one and then on the other, the depths being gaged by stops (Oper. 1-c.).

The next operation consists in rechucking the piece, turning the diameter and forming the recess in the face of the larger gear.

The pieces are then annealed, hand reamed, pressed on a special arbor and put in a 20-inch engine lathe to be finished by the special gang tool holder shown in Fig. 2. The four tools *A*, *B*, *C*, *D*, simultaneously finish the four faces to exact width, and round off the corner as shown. The carriage is then drawn back and the small gear is turned to exact diameter by the end of *D*, while the large gear is finished in the same way by the end of *B* hand tool. Accuracy of spacing of these tools is obtained by the taper wedges *E* and the side set screws *F*, while the angle at which the tools are held in the tool holder provides sufficient top "rake" and allows the tools to be ground flat on the top face.

Fig. 3 shows a somewhat similar tool outfit for the sliding transmission gear for an 18-inch Gisholt, the stock being 4½-inch vanadium steel bar, and finished in two chuckings, as shown. It is then annealed and broached and placed on a square arbor for finishing in the engine lathe by outfit shown in Fig. 4.

Fig. 5 shows a tool outfit devised for machining pistons on a 20-inch engine lathe. The pistons, after being thorough-

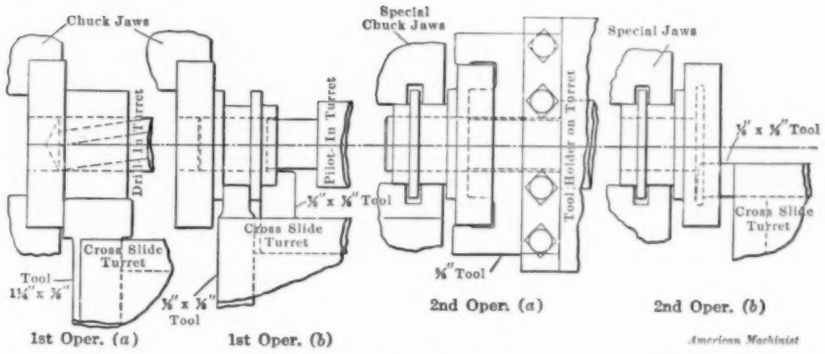


FIG. 3. TOOL OUTFIT FOR 18-INCH GISHOLT FOR SLIDING TRANSMISSION GEAR

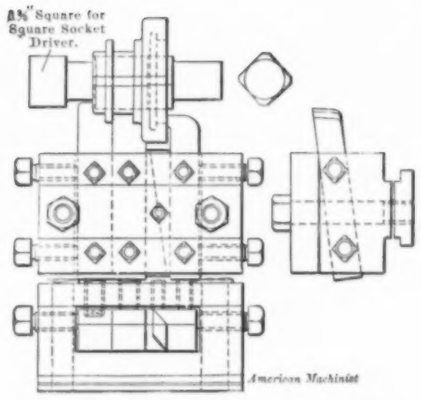


FIG. 4. OUTFIT FOR 20-INCH ENGINE LATHE FOR SLIDING TRANSMISSION GEAR

ly annealed, are first chucked in a special two-jaw chuck, and bored accurately to size. They are then put on the special face plate shown in Fig. 5 and held by the draw-in rod and handwheel, by means of the slip pin *A* in the connecting-rod pin holes. It is only necessary to turn the handwheel one revolution to remove the casting. The casting is driven internally by means of the semi-floating driver attached to the nose of the special face plate. This driver bears equally on each of the connecting-rod pin bosses, and floats on the flat key in a direction only at right angles to the line of the driving faces. This equalizes the driving strain, and at the same time presents distortion due to torsional strain or side thrust of the cutting tools. The piston is also held against side thrust by the tail center. The operations consist in rough turning, rough facing, rough grooving and finish turning by the four tools held in the turret head on the carriage slide, and then finish face, finish groove and cut oil grooves simultaneously by the special tool post and tools fitted to the back end of the carriage. A special four-point adjustable star wheel stop, with spring-actuated ball locating pawl, is attached to the lathe

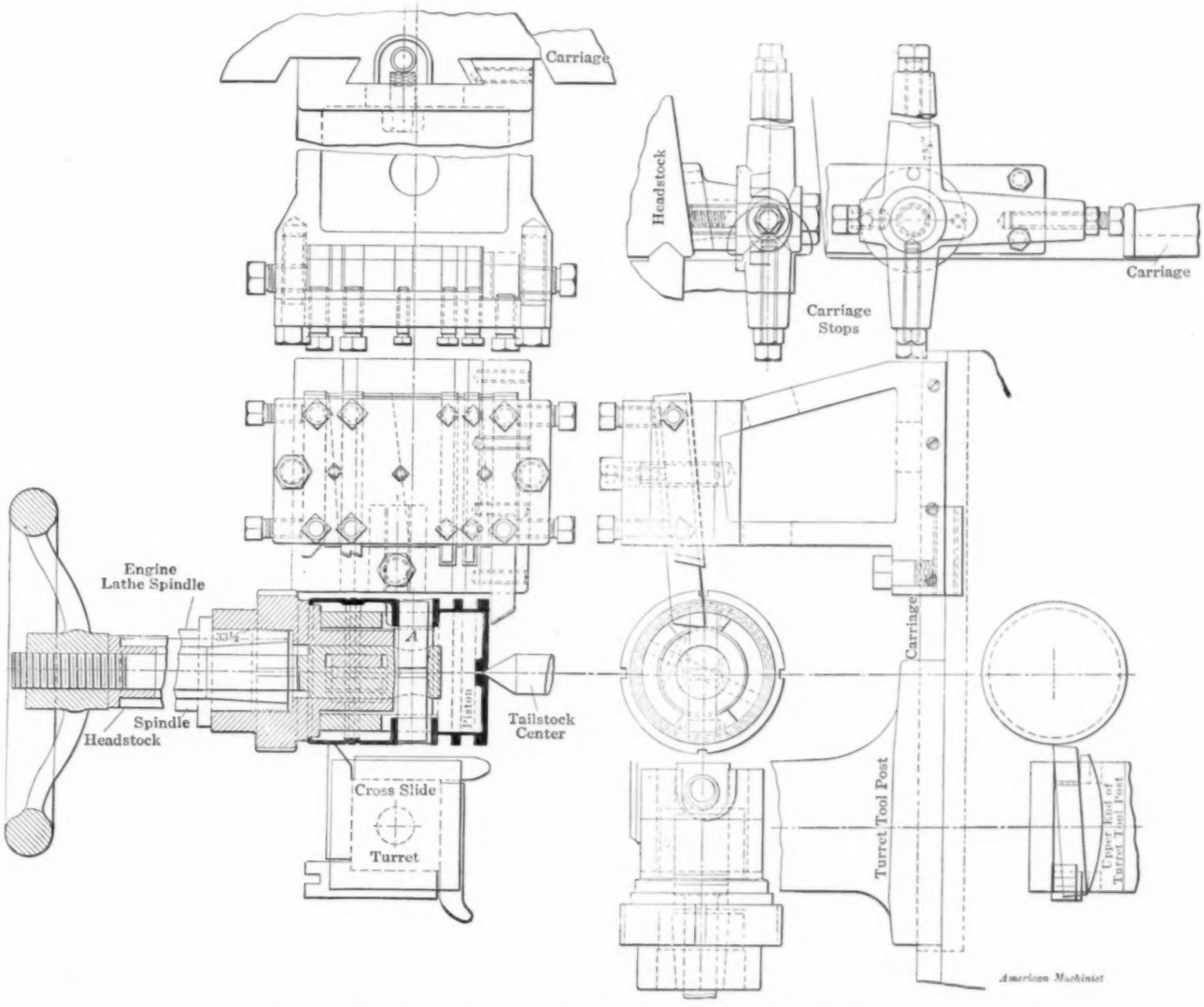


FIG. 5. PISTON TURNING EQUIPMENT FOR 20-INCH LATHE

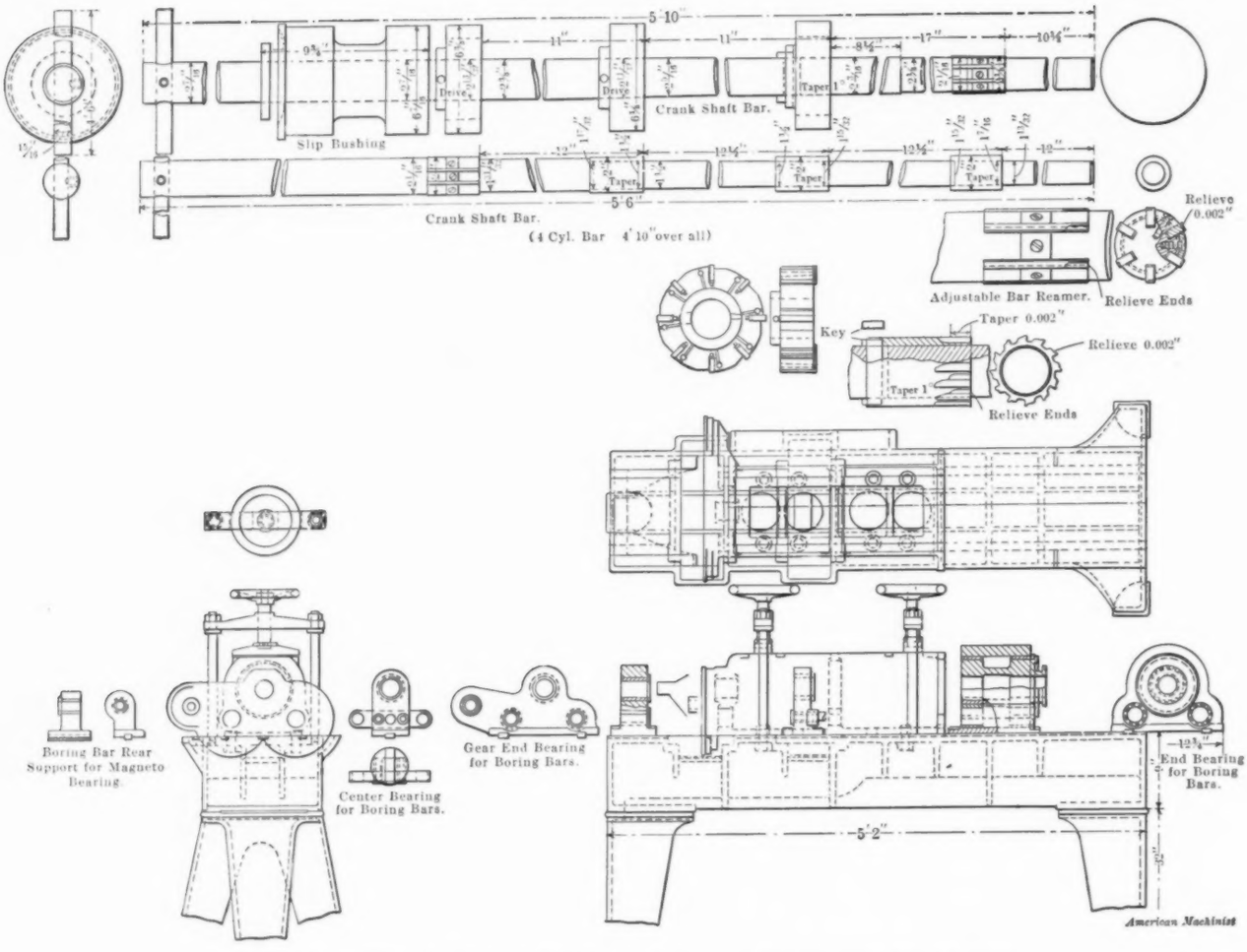


FIG. 6. LINE (HAND) REAMING DEVICE FOR FOUR- AND SIX-CYLINDER CRANK CASE

headstock, so longitudinal measurements are unnecessary. With this device it is possible to accurately finish eight pistons per hour. The same provision for flat grinding the tool faces and spacing the tools in the rear tool post is here employed as used in finishing the gear blanks previously described.

One of the difficult jobs of automobile building is to obtain accurately machined crank cases. Fig. 6 shows an elaborate fixture for line reaming, or hand reaming, cases after they have been finished on the lathe, milling machine, and horizontal boring mill. The device consists essentially of a heavy bed plate, some 14 inches wide by 9 inches deep by 62 inches long, of box section with heavy ribs both ways. The bed is mounted on legs that give it a three-point support. The crank case is located on the fixture by four plugs that fit into the poppet-valve holes at each end of the case. All studs and screws are put in the case before locating on the fixture, so that no distorting strains will be put into the case after reaming. The case is secured to the fixture by the equalizing clamp, screw and handwheel shown, and as the handwheel drives the screw by friction only, no excess of pressure can be exerted by these clamps. The reamers are so located on the bars that only one reamer is cutting at any time but each begins cutting just as the previous one finishes. The reamers are made with a slight "rose" point and a slight taper for a short distance from the

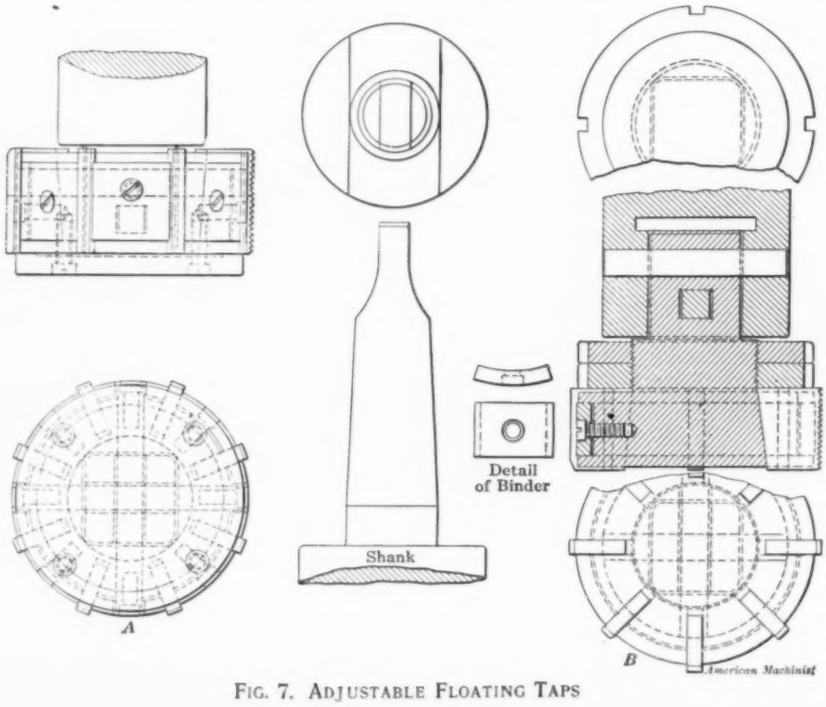


FIG. 7. ADJUSTABLE FLOATING TAPS

cutting end. The three types of reamers used are clearly shown in the drawing, which shows the bars and reamers for six-cylinder crank cases. The four-cylinder bars are similar, except shorter and rather simpler. A four-cylinder case is outlined on the fixture. In actual practice this case would be located as near the right-hand end of the fixture as possible, in order to use a shorter reamer bar. It is for this purpose that the second "drop" was put in the fixture bed. The fixture has a supporting bracket, with hardened steel bushings at, or near, each reamer to obviate all spring of the bar under cut. The first bushing is made very long (nearly 10 inches long) and chambered to prevent any spring or drop of the outer end of the bar from affecting accuracy of work. The cross-bar for supporting the cam reamer bar inside the crank case is put in place after the case is located on the fixture, and is drawn to its seat by a taper key (not shown) in the locating pin.

It is often advisable to use a floating tap or reamer on various lines of work. These are ordinarily made by fitting the shank loosely in a socket, and connecting the two by a loose pin. A tool of this kind is not accurate as the cutter bar tends to oscillate from the pin as a fixed center and so cause the tool to cut over size. Fig. 7 shows two designs of a floating tap to overcome this objectionable feature. The tap head is mounted on the shank by two square pins at right angles to each other and each having clearance on the sides only. The tap head fits the shank by the square socket and plug, which has clearance on all sides. This holds the tap head vertical at all times, and yet allows perfect freedom of side motion in any direction to the limit of clearance allowed. The taps shown are made adjustable; one being for a down feed, and the other for an up feed. The up-feed tap *A* was made for use on a transmission case, and had to be put in place on the shank after the casting had been placed on the boring mill, and had to be made as short as possible in order to get it in place, so the sliding pins were put in the tap head itself.

Training Engineers at Franklin Union

By F. L. Johnson

This institution, which owes its establishment to Benjamin Franklin, is an industrial school for men who desire an advanced knowledge and a wider experience in their vocations. Though covering a wide field in industrial pursuits it furnishes exceptional opportunities to the engineer.

In 1791, Benjamin Franklin bequeathed to his native town of Boston the sum of $5000, to be held in trust for one hundred years, during which time the principal and its accruing interest were to be lent at 5 per cent. per year for the purpose of aiding "married artificers starting in business."

At the end of the first century the fund was to be divided: A portion to be spent in such "public works which may be judged of most general utility to the inhabitants, such as fortifications, bridges, aqueducts, public buildings, pavements or whatever may make life in the town more convenient to its people and render it more agreeable to strangers resorting thither for health or a temporary residence."

In 1891 the first portion of the fund became available for the purpose intended. But owing to several reasons, among which were litigation and an attempt of the city government to spend a large portion of it in a junketing expedition to find out how to invest the rest of it, it was not used at that time.

It was finally decided that the Supreme Court of Massachusetts should be asked to construe the meaning of the terms of the bequest; this resulted in the appointment by the court of a board of twelve managers of whom but one, the mayor, could possibly be a public official or politician.

The men selected for the board of managers were Richard Olney, president; Nathan Matthews, vice-president; James J. Storrow, secretary; William Endicott, treasurer; Rev. Charles W. Duane, Frank K. Foster, Charles T. Gallagher, Mayor George A. Hibbard, Rev. Alexander K. MacLennan, Rev. Charles E. Park, John A. Sullivan, Prof. George F. Swain. In the judgment of this board an industrial school was deemed the one public work of the "most general utility to the inhabitants of Boston," and some $400,000 of the fund was expended in building and equipping the Franklin Union.

As practically all of the available fund was spent in buying the land, erecting the building and supplying its equipment, nothing remained for the support of the institution. Andrew Carnegie, learning of the situation, gave a fund which provides for an annual income of $20,000 which, with the nominal sums received for tuition, furnishes the entire revenue of the institution. This, though inadequate, permits about one-half of the building to be utilized for the purposes intended.

In its equipment for practical teaching the institution is radically different from the ordinary manual-training school. Instead of competing with existing schools of a kindred nature, it supplements their work.

The foremost idea from the beginning has been the teaching of men. In the selection of the entire equipment this object has been kept in view. It aims to

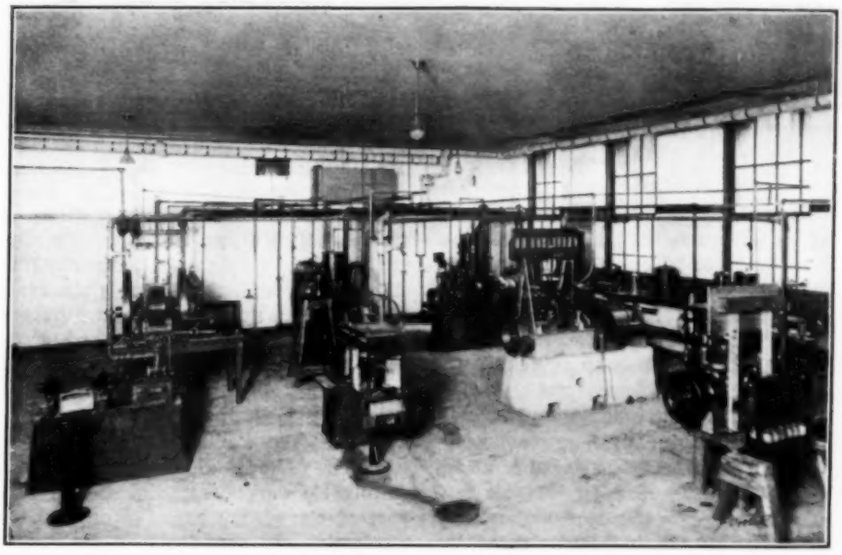


FIG. 1. GAS- AND GASOLENE-ENGINE LABORATORY

reach men having more or less limited experience and knowledge of their vocations with a view to increasing their experience and perfecting their knowledge.

The instruction is less of a technical nature than that given at some older and larger institutions, and is more practical than can be obtained at the evening classes of the public schools, the Young Men's Christian Association classes or the regular trade schools. As the best methods of teaching trade practice and theory are to be found in the commercial shops and enterprises, the methods of the Franklin Union have been shaped to closely follow present-day shop practice.

Instructors, so far as is possible, are selected from the shop, the engine room, the commercial laboratory and from the building trades and professions. Shop language and shop problems afford the student, with his practice instruction in shop work, the most practical way for advancement.

Though the course of instruction covers a broad field embracing several trades, there is but little that is not either directly or indirectly related to the engineer and his work; and there are probably few who would not be benefited by a course at the institution.

The character of the instruction being practical, a student who is qualified may have additional work as an equivalent for that in which he is already proficient. The arrangement of the courses is the result of the most careful planning on the part of the instructors, who have not hesitated to take advantage of many valuable suggestions made by the students, making the studies of the highest value to the man from the shop or power plant.

Evening classes are held on Monday, Wednesday and Thursday evenings, from the last of September to the last of March. Two-year courses are given in the following subjects: Machine construction, industrial electricity, steam engines and boilers, structures, architectural working drawing, industrial chemistry.

Classes, without certificates, continuing for one season: Sheet-metal drafting, mechanical drawing, industrial arithmetic and shop formulas, estimating for architects and builders, firemen's class, heating and ventilating, practical mechanics, heat and hydraulics, gas and gasolene engines, ship and yacht drafting.

Saturday afternoon classes are held in industrial chemistry, steam engines and boilers, industrial electricity, gas and gasolene engines and industrial arithmetic. The instruction covers the same ground as the evening courses.

A glance at the course of instruction will show that the steam, mechanical and electrical courses constitute only a small part of the field covered by the curriculum; these, however, form the portion of greatest interest to engineers.

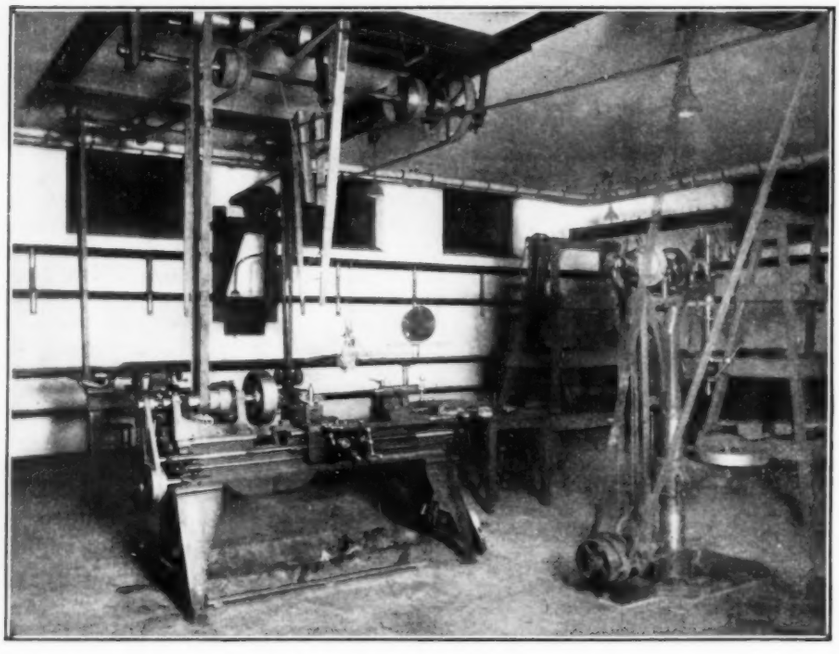


FIG. 2. A CORNER OF THE MACHINE SHOP

The mechanical laboratory includes a 10,000- and a 40,000-pound Riehle testing machine; a Fairbanks cement testing machine; 5 Fairbanks scales; a planer; a tool lathe; an upright drill and a duplex chain falls, belts, pulley blocks and shafting.

All of the apparatus in the steam- and gas-engine laboratories is directly under the supervision of George H. Bird, superintendent of the building, who is an indefatigable worker, spending the greater part of his waking hours in original investigation and experiment in the steam-engine laboratory.

One line of his investigation has been in the direction of finding the cost of leaks in the valves and pistons of steam engines. After ascertaining that the piston and valves of the 8x24-inch Cooper engine were tight, he drilled holes through them into which he fitted plugs, which could be removed to introduce any desired kind of a leak in the piston, steam valve or exhaust valve, individually or in concert. Loss from one or a combination of leaks was measured by weighing the water drawn from the Wheeler surface condenser.

Junk shops and second-hand machinery depots are ransacked for anything that will furnish work or instruction for the

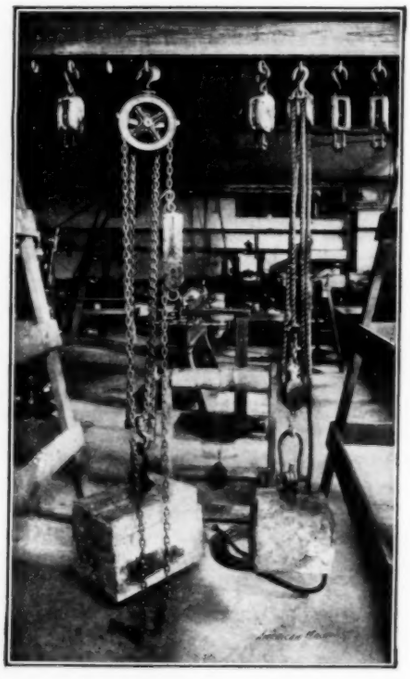


FIG. 3. APPARATUS FOR SHOWING HOW HOISTS WORK; CHINESE WINDLASS IN BACKGROUND

students, who by actual hand work get, in one short term, an experience under able supervision that probably would not come to them in years of service in an ordinary power plant.

In an almost endless variety, problems in steam-engine installation, adjustment, operation and repairs are furnished. One group may use the Riehle testing machines on test pieces of boiler plate or concrete prepared by another group. A small class may today assemble an engine or a pump which was taken apart yesterday. Here a few are adjusting a riding cutoff designed by others, while their own design will be taken in hand next week by others, and so on through the entire course, including boiler tests, flue-gas analysis, design, operation and repairs of feed pumps, condensers, circulating and air pumps, lubricators, prony brakes, safety valves and every appliance connected with steam engineering. In the electric, gas and gasolene engine

and the chemical laboratories the methods of teaching follow the same lines as closely as possible, making the instruction practical in every feature.

It is interesting to watch the classes at their work; so intent are all in making every minute count for something gained. One of the illustrations shows a group at work in a corner of the engine room; some are at one thing and some at another, while at the left is seen a relic of other days—an old horizontal-tubular boiler built in 1862.

That part of the curriculum of greatest interest to engineers is embraced in steam engines and boilers, which covers two years and comprises lectures and laboratory practice for engineers, oilers and steamfitters. In the first year the subjects are boiler details; fittings, setting, installation, fuel and combustion; construction and operation of pumps and simple engines; setting plain slide valves. Those for the second year are Corliss and other automatic cutoff engines; heat and the generation and properties of steam; compound engines, condensers, indicators, elevators and refrigerating machinery.

The course in industrial chemistry, though intended for young men employed in chemical-manufacturing plants, mills and drug houses, and for men who wish to acquire a practical knowledge of the principles and applications of chemistry, should not be passed by the engineering student if time can be afforded for even only a part of the course. The first year includes lectures and laboratory practice in elementary general chemistry. The second year includes qualitative and quantitative analysis. The third year offers an opportunity for instruction in commercial analysis and for specialization on industrial problems.

The entire course covers lectures, recitations and experiments in elementary chemistry, general chemistry, qualitative analysis, quantitative analysis, organic chemistry and commercial analysis.

Besides these there are complete and partial courses in sheet-metal drawing and mechanical drawing. Study in heating and ventilating can be followed to advantage by the practical steam and gasolene engineer, as the power plant in the building is available for this work.

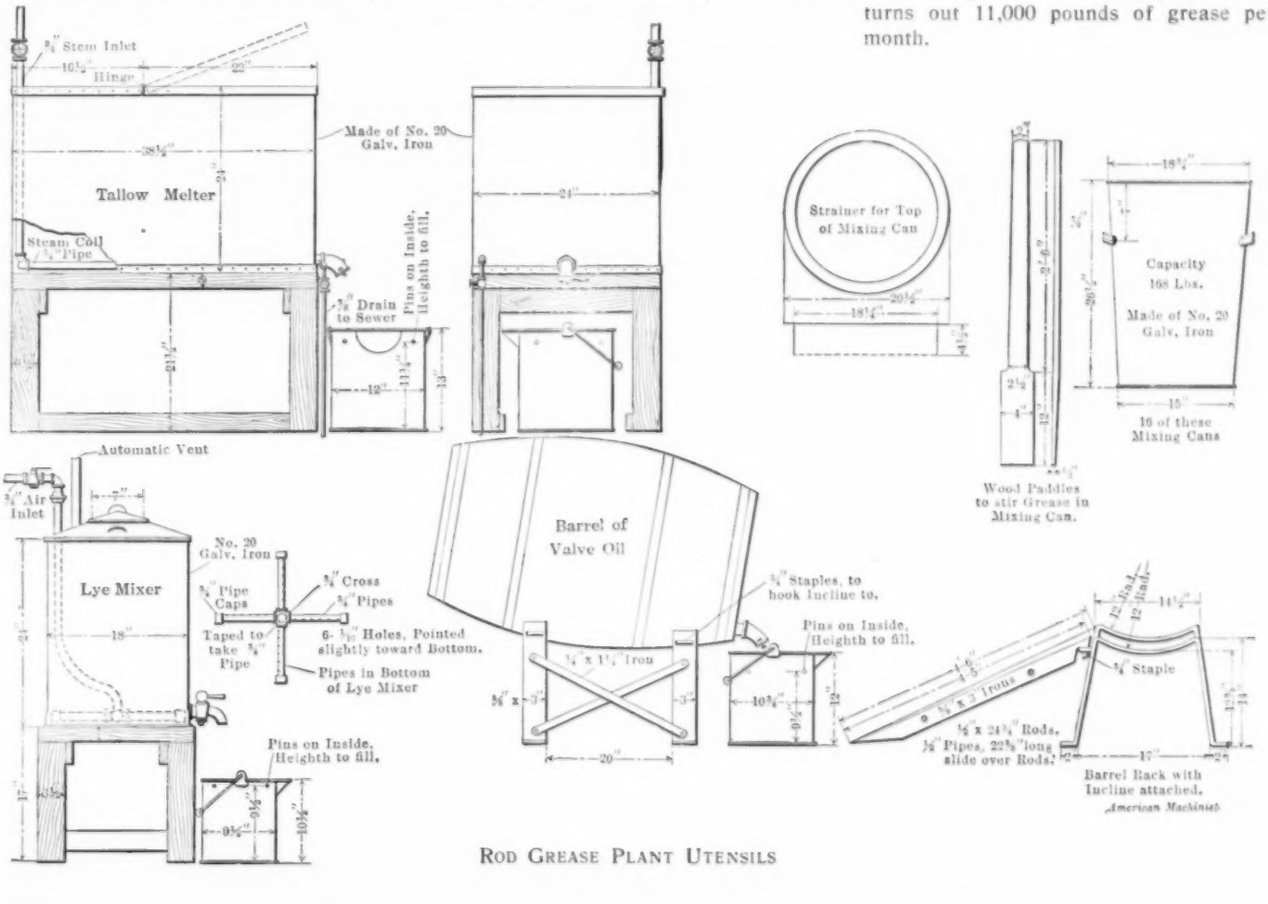
Walter B. Russell, a graduate of Massachusetts Institute of Technology, also graduate of and later instructor at the Pratt Institute, Brookyln, N. Y., who was associated with C. W. Cross, superintendent of apprentices for the New York Central Railway lines and was in no small measure responsible for the efficient apprenticeship system of these roads, was selected by the board of managers for director of the Franklin Union. The steady improvement in the effectiveness of the instruction, the positions in industry secured by graduates and the fact that the applications for admission far exceed the capacity of the institution furnish ample evidence that no mistake was made in this selection.

Making Locomotive Rod Cup Grease

By W. J. Shadle*

The line cut gives details of equipment used to make rod-cup grease and shows a can at the tallow vat with wood pins inside of the can which designate the amount of tallow to put in it. The strainer is shown which belongs in the top of the mixing can, also the wood paddle to mix the ingredients. Mixing cans are made tapering so that finished grease will release itself readily when the can is upended. The lye mixer is shown which mixes the caustic soda by air forced through the 1/16-inch holes in pipe. The barrel rack with the inclined attachment allows one man to roll the barrel in position to be drawn off into cans. All cans have wood pegs located at different hights for each ingredient; by this method all mixtures are uniform. One man is all that is required to run this plant which turns out 11,000 pounds of grease per month.

*General foreman, C. & N. W. Ry., Clinton, Ia.



ROD GREASE PLANT UTENSILS

Machining Marine Connecting Rods

By S. Laurance

A branch of the machine business in which few jigs or templets are used and in which the skill of the mechanic is of paramount importance.

In the heavier branches of engineering, such as marine work, etc., jigs, fixtures, etc., cannot be adopted to any great extent, therefore much depends on the workman's skill. A man who is not accustomed to handling heavy jobs is apt to be lost even in the mere operation of lifting the work about with a crane, turning it over and setting up, etc. The way a "lightweight" handles heavy work with a crane is ludicrous.

The job described herewith is a heavy forged steel marine connecting rod. These rods are machined all over with a fine finish, and possess a high degree of accuracy. The forgings are first centered and mounted in a heavy engine lathe of not less than 48 inches swing, as shown in Fig. 1. These lathes usually have two carriages on the feed, so that both can be in operation at the same time. The two angle plates *A* act as drivers and are secured to the face plate by stout bolts. As heavy work of this description cannot be forged as close to size as lighter jobs, the T-end is first faced off to bring the forging nearer to finished size. This is shown at *B*, in Fig. 2.

The rod is then recentered in the solid end, as no center in a heavy job like this will keep true, if it is in a small projection like *B*. After recentering it is faced down again with a sharp-pointed side tool, and a shoulder about ¼ inch wide left on as shown, at *X* in Fig. 3, to serve as a gage to plane the T-end for thickness. The top of the T is now rough-turned, then the back, and the radius down to the straight part, as shown, leaving this about ⅛ of an inch larger than finished size.

While this operation has been proceeding, the other tool has been roughing the part marked *B* 1, gradually working down the tapered part and turning the smallest end down to the same size as the large end. There is always plenty of material left on for this. The straight part of the rod is now turned parallel, leaving it about ⅛ of an inch over the finished size at the thick end. The forging is then turned end for end and *F*, Fig. 3, is faced to within about ¼ of an inch of the finished length, leaving the shoulder *X* 1 as a gage to plane the end to.

The forgings then go to a large planer, and as these rods are generally made for multiple-cylinder engines, we clamp two or more of them on the table at once, as shown in Figs. 3 and 4, and use two tools; for forgings of this size it is best to rest the work in V-blocks *G*, as shown in Fig. 4, and clamp down with the clamps *H*. This method is more satisfactory than swinging on centers. *E E* are wedges to pack up the overhanging end and keep it supported under heavy cuts. Stops, as shown, are put in the table to prevent the rods from sliding.

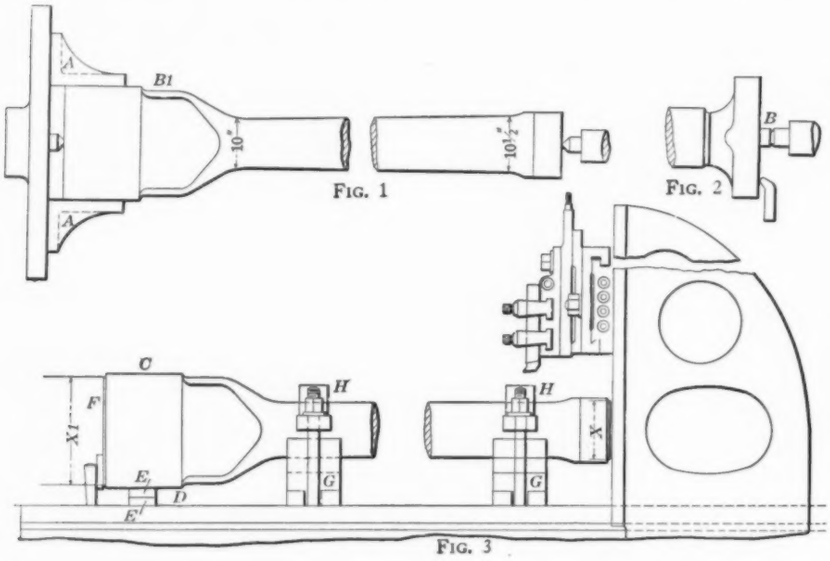


FIG. 1

FIG. 2

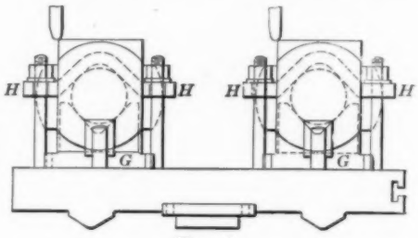


FIG. 4

FIG. 3

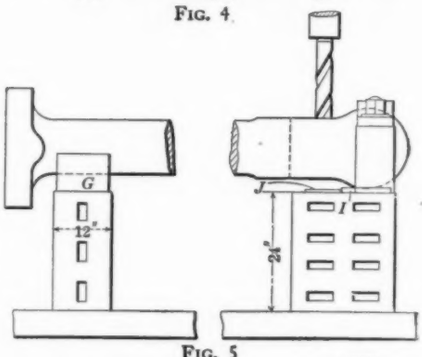


FIG. 5

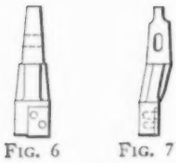


FIG. 6

FIG. 7

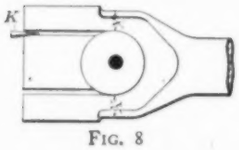


FIG. 8

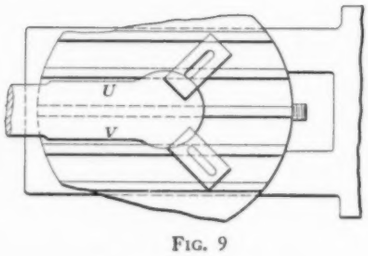


FIG. 9

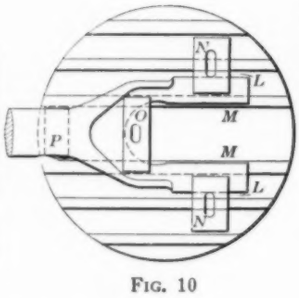


FIG. 10

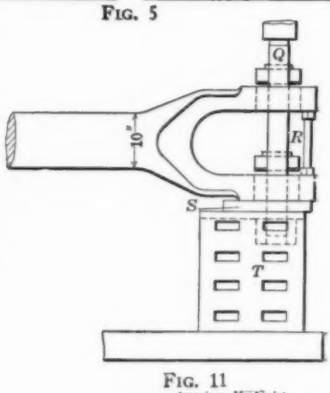


FIG. 11

American Machinist

MACHINING HEAVY MARINE TYPE CONNECTING RODS

The T-ends are first planed down to the register *X*, next the solid end *C* is roughed, then both ends are finished to a fine polish with a spring tool, and a good supply of soapy water. The rods are turned in the V-blocks, and the opposite surfaces are completed to width. The forgings are then turned a quarter of a revolution, and one side of the solid end is trued up exactly square with the faces *C* and *D*, to locate from when boring out the eye to make the fork end, as shown in Fig. 5. This operation is done on a heavy vertical duplex-spindle, milling, boring and drilling machine of the Hetherington type. The forgings are packed up on parallels, as shown, the ends resting on the two planed strips *I*, and the back ends being packed up level. The two clamps shown secure the front ends, and a clamp similar to *H*, Fig. 4, is secured on the straight part of the rod near the opposite end.

J shows a brush let into the packing block, to support the end of the boring bar when boring the eye out. We first run a 2-inch twist drill through, as shown, then open out to 6 inches diameter at one cut with the powerful D-bit, shown in Figs. 6 and 7. These require enormous driving power, and in addition to the flat on end of tapered shank are driven by a stout cotter through the hole. We next finish out to size with a heavy boring bar and flat cutter, the bar being steadied in the bush *J*. When bored to size the end looks like Fig. 8.

We now mount the partly finished rods in the lathe again, to finish turning to size and polish them, as several of the heaviest operations have now been completed, therefore the polished surface will not get damaged with ordinary care. First the register *X* on the T-end is turned off and face finished to length. The top of the T-end is then finished at the same time the opposite end is being finished. The rod is then turned to finished size at both ends and polished with a spring tool and soapy water. Sheet-steel radius templets are used by the turner for this job. The tailstock is set over ¼ inch and the tapered part is finished to size and polished with a spring tool. We now take the forgings to a large band saw, and saw out as shown at Fig. 8. When the saw gets in, drive a wedge *K* to spring it open from *X*, to give clearance for the saw, otherwise it will close up, due to strains in the forging, and break the saw.

After the center piece has dropped out we clamp the end down on a 24-inch stroke slotting machine table, as shown in Fig. 9, using two distance pieces between the jaws to prevent them springing. We now complete the two sides *U* and *V*, and work out the radius on each side by hand to a templet; we then remove the clamps to the sides and slot around the end with the automatic circular feed on. The rod is then clamped, as shown in Fig. 10, by the three clamps *N N* and *O*, and slot the inside faces *M* to finished width, supporting the rod on the packing piece *P*, and also at the outer end on a trestle and roller, it will be found that the two surfaces *L* will have sprung somewhat by sawing out the center piece, so we clamp from the inside and take a finishing cut off these faces, which brings them true again, to locate from, as shown in Fig. 11. To bore the hole for the crosshead pin, which must be dead square with the rod, we clamp down on the parallel boxes *E* and packing strips *S*, and insert the distance piece *R* to prevent springing when clamping down. The rod is set dead level and a 2-inch twist drill is first run through a D-bit, open it out to 6 inches and the boring bar *Q* and cutters shown finish the hole, a bush in the box packing *T* steadying the bottom end of the boring bar.

These rods call for accurate and highly finished work, and by following the sequence of operations here described we turn them out in the minimum time without a lot of unnecessary handling, no small item on heavy work of this description.

New Forms of Ames Dial Gages

Editorial Correspondence

A neat design of holder carrying a dial gage arranged for use in automobile and other cylinders for testing the accuracy of the bore, the movement of the pointer showing by fractions of a thousandth any irregularities in the surface of the work.

Readers of the AMERICAN MACHINIST are well acquainted with the dial-test gage made by B. C. Ames & Co., Waltham, Mass. This gage has already been manufactured in various forms to adapt it to a great variety of work in different factories, and the makers have recently brought out some new types which add still further to the uses to which the instrument is adaptable.

GAGE FOR CYLINDERS

In Fig. 1 is illustrated one of the new designs in which the gage is manufactured, this form being intended especially for testing the bores of automobile cylinders, or of cylinders of much larger diameter for engines, compressors, etc.

In the model shown, the dial gage in its familiar form is adjustably mounted in vertical position in a neatly designed base which is finished flat across the bottom and thus presents two clean edges upon which the gage rests when slipped into the bore of the cylinder. A finger opening is formed in the base, and the tool is readily slid into the work with the top of the plunger pressing against the upper wall of the bore. The dial may be turned to bring the zero line coincident with the pointer, and the gage may then be slid along the bore with the assurance that any irregularity in the bore diameter will be truthfully indicated by the fluctuation of the pointer past the graduations on the dial face.

The three gages in Fig. 1 are so placed as to show clearly the outline and proportions of the base in which the gage is mounted. In Fig. 2 the gage is shown in position in an automobile cylinder, which is being tested after having seen considerable service. Naturally, the chief field of usefulness for this tool is the factory where cylinders are produced, although, as indicated by the illustration, the tool should be found a very handy one in inspecting cylinders of engines undergoing overhauling operations in garages and repair shops.

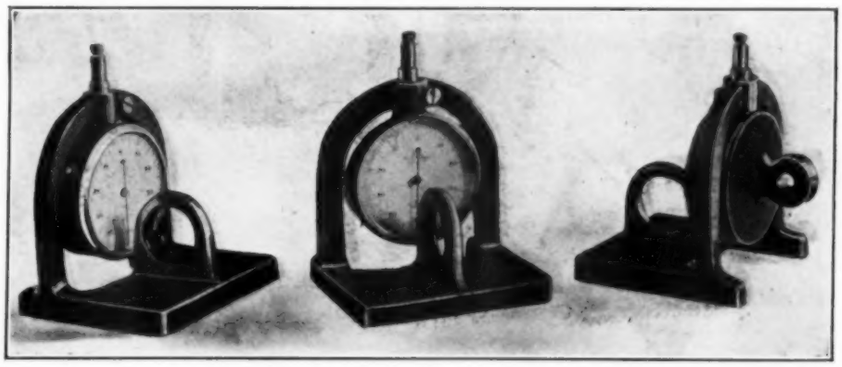


FIG. 1. THE AMES CYLINDER GAGE

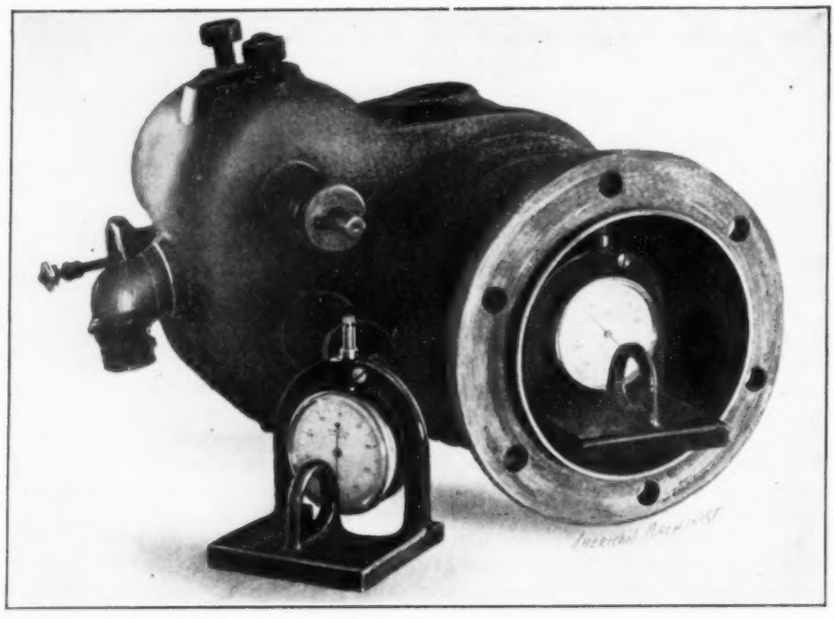


FIG. 2. THE GAGE AS USED IN AN AUTOMOBILE CYLINDER

GAGE AND MASTER RINGS

The scheme illustrated by Fig. 3 is an idea of Mr. Ames' for enhancing the value of the gage in the shop regularly manufacturing cylinders. This illustration represents a casting bored out to correspond exactly with the bore of the regular cylinders, thus acting as a master or reference piece in which the test gage may be kept when not in use, and which gives at all times the gage reading to which all the cylinder bores must conform to pass inspection. This reference piece is a suggestion upon the part of Mr. Ames which should be found valuable to those utilizing this form of gage.

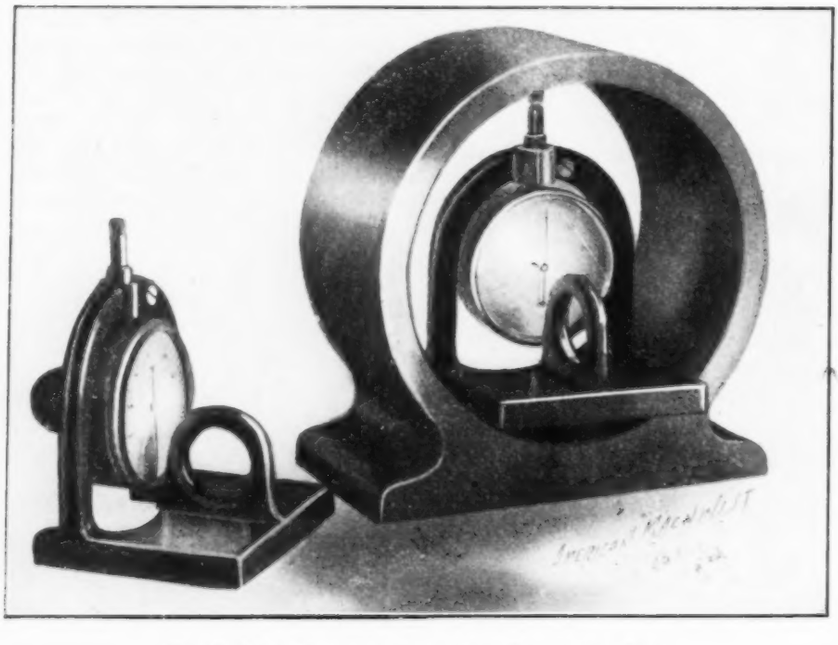


FIG. 3. THE CYLINDER GAGE IN A REFERENCE RING

It is obvious that any limits permitted in the cylinder bore are readily checked by the gage as it is passed through the work, and the tool may, of course, be turned around to any position, and the bore thus not only tested throughout its length for uniformity of diameter, but also for roundness.

By removing the contact point on the plunger, an extension pin or wire of any desired length may be attached and thus the gage may be readily adapted for use in cylinders of large bore. There are numerous other applications to different classes of work which will suggest themselves to the practical mechanic.

GAGE FOR LARGE SHEET WORK

Another form of gage intended for large pieces of thin material is illustrated by Fig. 4. Here the dial gage is shown in a frame which has a throat over 24 inches in depth, this being designed to test sheet metal, rubber or other materials up to 48 inches in width or diameter. The arm upon which the gage is carried, has

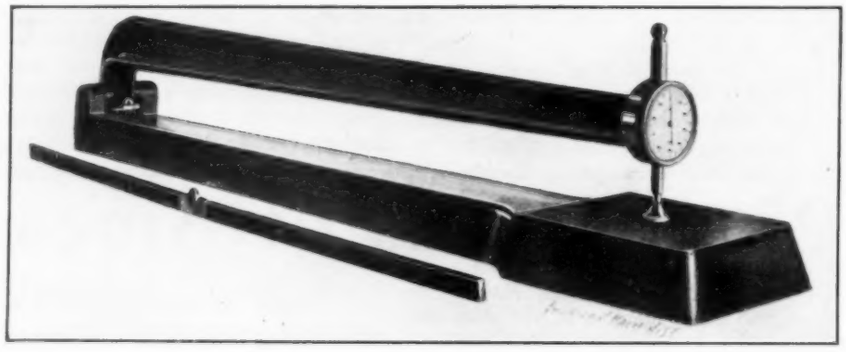


FIG. 4. DIAL GAGE WITH SPECIAL FRAME FOR LARGE SHEET MATERIAL

at the rear end two adjusting screws by which the instrument is easily set to suit the work, and with the contact plunger resting upon the sheet to be inspected, the latter may be moved around quickly and its entire surface readily tested.

F. A. S.

A Mixture for Dry Hydraulic System

This lubricates the rams and valves and prevents packing from becoming hard.

Secure a clean, empty barrel. Into the empty barrel place 5 pounds sal soda (the addition of 5 or 10 gallons of hot water will readily dissolve the soda), then fill the barrel half full of water, agitating same, so that the soda and water will be thoroughly mixed and dissolved. When done, and not before, add 3 gallons of mineral lard oil. This mixture will turn white, resembling milk; then fill balance of barrel with water, mix well, and the solution is ready for charging the hydraulic system.

Weighing Materials Automatically

Editorial Correspondence

An important problem in the manufacture of products sold by weight which is successfully solved by the use of accurate mechanical devices.

There are many industries which require the continued weighing of given quantities of material over long periods of time, such as the manufacture of food products which are put up in half-pound, one-pound or larger packages and also in such industries as the cement business, where given quantities of different materials have to be mixed together in their correct relative proportions. If such work as this were done by hand with an ordinary weighing balance, it would be so slow as to vastly increase the price of the product.

One company making automatic machines to do this work is the Automatic Weighing Machine Company, of Newark, N. J., and one of the more complicated of its machines is that shown in Figs. 1 and 2, which represent an automatic device for weighing out baking powder in one-pound quantities. This machine, one of which is operating in the Grand Union Tea Company, of Brooklyn, holds a tin can in a suitable position to receive the powder, packs it down so that it fills the can in an economical manner, and passes the filled can out to a belt conveyer to be carried over to the boxing room.

Above the machine is a hopper, which contains a large quantity of baking powder, coming from the mixers and grinders. From six spouts at the bottom of this hopper the powder flows in six continuous streams, the continuity of the streams being insured by rotating agitators in the upper hopper. These six streams of powder are directed down into six funnel-shaped weighing flasks, each flask being provided at the bottom with a spring door which is normally held in a closed position. These weighing flasks are balanced on knife edges by suitable weights so that when exactly one pound of material has been dropped into each flask the latter will overbalance and drop down a distance of about 2 inches. The dropping down of the flask brings a small overflow chute at the top of the flask exactly opposite the spout of the hopper overhead. The effect of this is to allow the continuous stream of falling powder from the hopper to pass through the overflow spout entirely free from the weighing flask. In this way no more powder is added to that in the flask after the proper weight has been reached. This overflowing powder is again lifted by a suitable conveyer, to the top of the machine, putting it back into the hopper.

Just after the six flasks have been overbalanced, six sets of cam-operated fingers open the spring doors on the bottom of the flasks, dropping the weighed powder down through suitable tubes leading to the spouts which fill the cans. In order to insure that the extremely light powder shall flow properly, six hammers are brought up to strike vigorously against the sides of the tubes, the motion being imparted by suitable cams.

On the floor of the machine there is a traveling rubber belt over which are six sets of stationary guiding rods. On the traveling surface of the belt and between the rods an attendant places about 50 empty baking-powder tins, in six rows. The progress of the belt is in steps and at each step the six tins in the front row

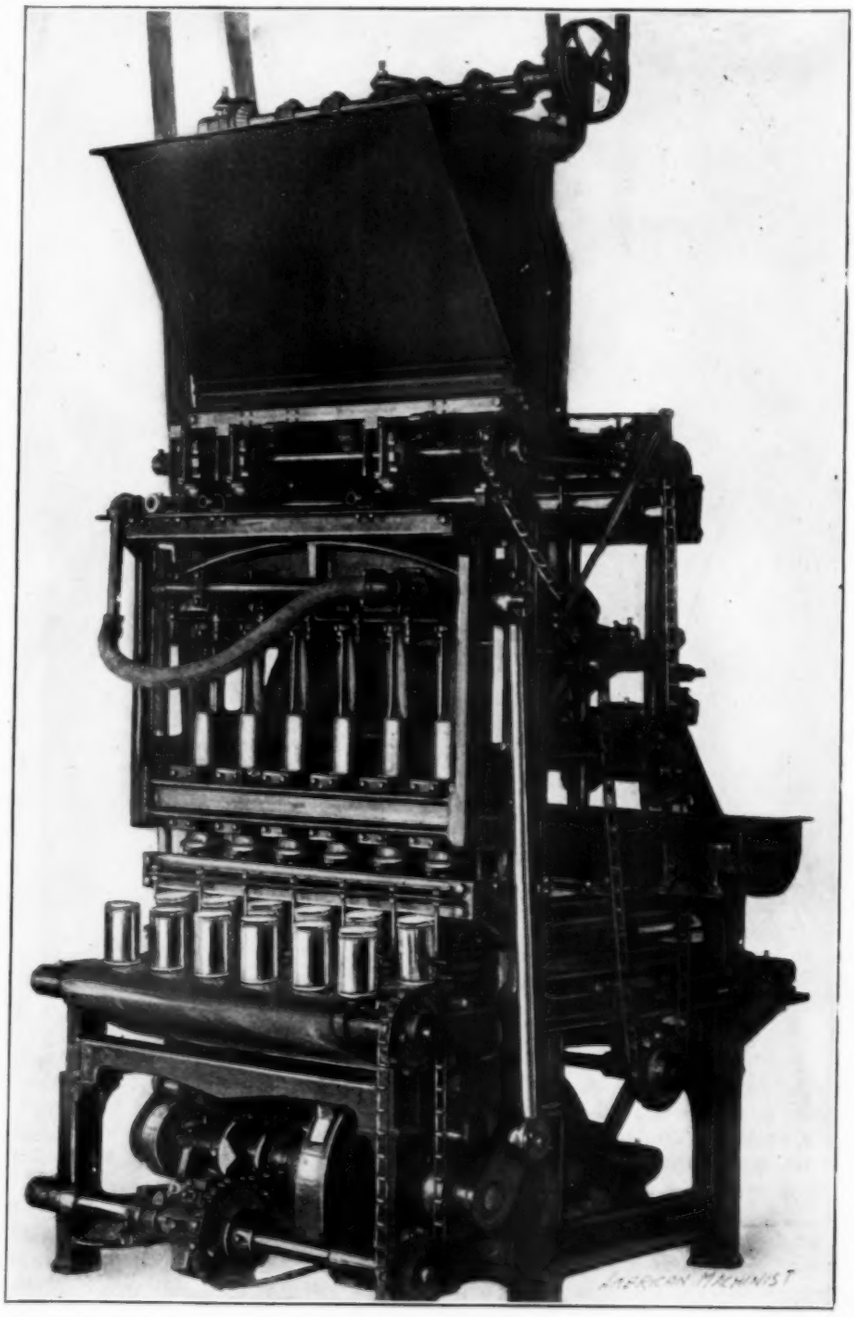


FIG. 1. AUTOMATIC MACHINE WHICH WEIGHS BAKING POWDER AND PACKS IT IN TINS. DISCHARGING SIDE, SHOWING PACKING PLUNGERS

are carried forward and held by suitable fingers directly under the six filling spouts. While in this position, a platen underneath the rubber belt raises all six of the tins, pressing their tops tightly against felt washers at the bottom of the filling spouts, to receive the falling powder.

Baking powder is very loosely packing material, and in order to be economical of packing space, it is necessary to compress it, and this is done by six plungers

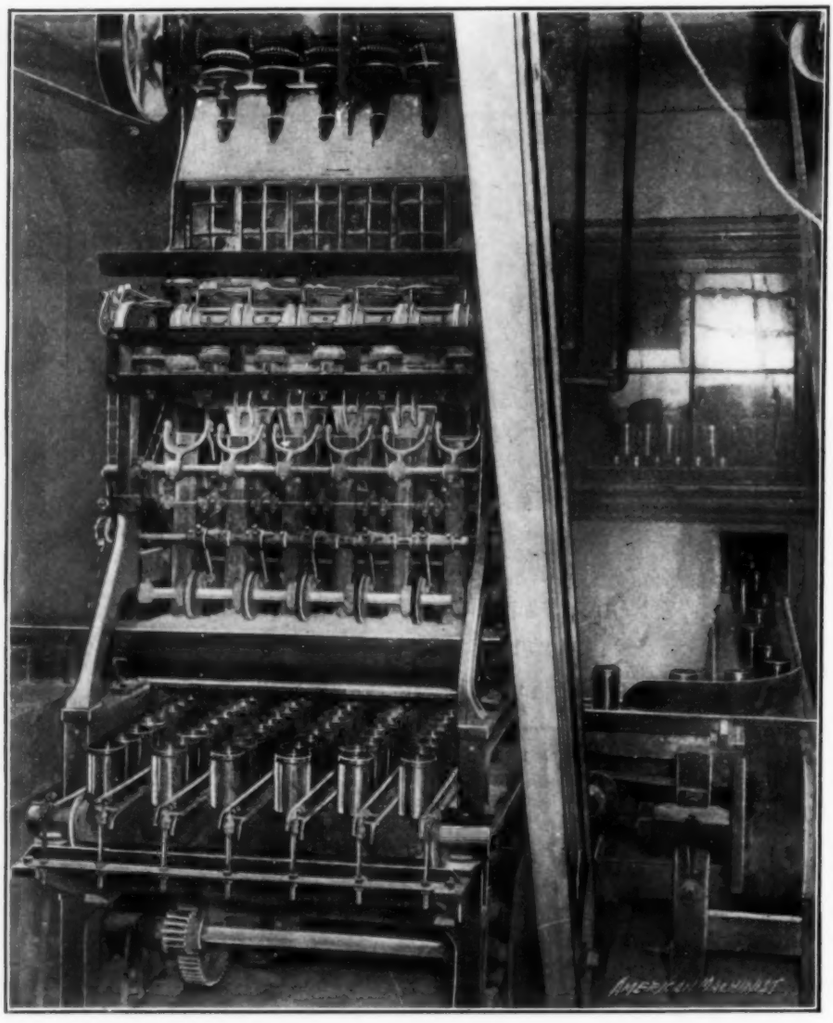


FIG. 2. BAKING POWDER WEIGHING AND PACKING MACHINE. ENTERING SIDE, SHOWING CONICAL WEIGHING HOPPERS WITH CAMS AND LEVERS; ALSO EMPTY TINS ON FEEDING BELT AND FILLED TINS PASSING THROUGH WALL ON CONVEYER

which come down through the filling spouts and press upon the powder in the cans, packing it firmly down into position. At the same time a valve in a vacuum line is opened by a cam so that the air in the powder in the can is drawn out through an extremely fine-mesh screen in the bottom of each plunger. Next, the plungers lift up, the fingers release the cans, the belt travels forward, delivering the filled cans and bringing up the next row of six to be filled.

THE SIMPLEST FORM

To turn from this more complicated machine, Fig. 3 represents one of the simplest automatic weighing devices which is manufactured by this company. From this halftone it will be seen that the material, which must be of a free-flowing character, is fed to the machine from the funnel at the top.

In this particular case the machine is adapted for automatically weighing from four ounces up to two pounds. The speed of weighing depends upon the material handled; one-pound lots of whole coffee can be handled at the rate of 15 packages per minute, while rice, which flows more freely than coffee and is a heavier material for a given bulk, can be weighed at a speed of about 20 packages per minute. Material flows from the funnel down through a pair of doors into an aluminum weighing bucket shown below, which is balanced on the horizontal scale beam upon whose other end may be placed the usual weights of a standard equal-balance scale. In fact, this portion of the weighing machine is a standard product of a well known company turning out scale balances and is simply incorporated into this automatic machine as it stands.

At the bottom of the rectangular weighing bucket are two doors which open outward, not unlike the blades of a dredge bucket. Normally these doors are held shut by suitable latches, so that the material cannot drop through them. The balance is such that if at the left-hand end of the scale beam a one-pound weight is placed, the material flows into the weighing bucket until a little over ¾ of a pound has entered it. At this time the weighing bucket starts to move downward, due to the fact that there is added to the weight of the bucket and material a slight pressure of the weight of one of the gates on the funnel above.

As soon as the bucket starts downward this first gate is shut off, stopping the greater portion of the stream of flowing material. What is known as the "drip stream" then continues to flow down into the bucket. Because of the fact that the bucket has moved downward, closing the first preliminary door, the weight of this door has been removed from the weighing bucket and consequently it does not move through its full travel corresponding to a correct balance. Therefore, the weighing bucket remains in an intermediate position, while the drip stream continues to add material to that in the bucket at a comparatively slow rate, gradually building up the weight until it becomes equal to the counterbalance weight at the other end of the beam, which we have assumed in this case to be one pound.

At this point, of course, the scale balances and the weighing bucket descends. This final dropping down of the weighing bucket releases the catch of another gate on the upper funnel so that it comes closed with a quick motion, entirely shutting off the flow of material into the weighing bucket. Under these conditions when the correct adjustments are made, the weighing bucket contains just one pound of material. The final motion of the bucket releases a pair of latches controlling its doors at the bottom and the weight of the material inside causes these doors to open, dropping the material down through the lower funnel into any receptacle placed there to receive it. Suitable levers make it possible, if desired, to discharge the material from the weighing bucket by hand; that is, the bucket will then hold the material until actually released by the operator. The speeds given for weighing coffee and rice assume that the automatic dumping attachment is working and receptacles are placed under the lower discharge funnel fast enough to catch the material as it is weighed.

For such a machine as this the weights

turned out will be within 1/16 of an ounce either above or below an absolute balance of the weight selected. The greater percentage of the weights would be actual balances, but owing to slight fluctuations in the supply of material from the upper hopper, the weight might vary as much as 1/16 of an ounce in either one direction or the other.

The Conditions of the Problem

It may be well to state here some of the difficulties encountered in automatic weighing machines. Of course, the speed of flow of the material into the weighing bucket depends upon the pressure of the material above it. In other words, if the "head" due to the quantity of material in the upper hopper should vary, the speed of the flowing material would also vary, so that the size of the stream of material would not always be the same. It will be clearly realized that the balancing of the weighing bucket which acts to close the final door against the flowing material must take place just a little before the actual weight has entered the bucket. The reason for this is that when the doors from the upper funnel have been closed there is a certain amount of falling material still in the air which has not yet dropped down into the weighing bucket.

It is for the purpose of cutting down this quantity of material still in the air after the closing of the gates that the drip stream has been devised. If the full, rapid flow of materials were to be suddenly shut off without diminishing the drip stream, there would be a very much larger quantity of material in the air which would have to drop down into the weighing bucket, and this would give an opportunity for considerable inaccuracy in the weights obtained. Now, however, by cutting down the size of the stream by means of the preliminary door, the final adjustment of the weight is more slowly accomplished and when the final door is at last sharply closed there is only a small amount of falling material left in the air. The smaller this is, the smaller the possible error in weight.

As a rule, as intimated, the weights are very accurate when the weight or head of the material causing the flow remains nearly constant. For some materials it is so essential to keep this head constant that a certain quantity of the material to be weighed is first dropped into a hopper overhead, so arranged that if the quantity in this hopper is below normal, the flow from the hopper into the weighing machine proper will be stopped until this weight comes up to what it should be. This is accomplished in some cases on an ordinary balance principle and in some other cases by the pressure exerted on a bellows in the side of the upper hopper, so designed as to control the gate below it. Still other materials which are not naturally free flowing must be provided with a mechanical agitator in the shape of revolving blades to keep the stream constantly moving. All of these complications are for the purpose of obtaining greater refinement and accuracy in the weights of the materials handled.

As may be supposed, these machines are not necessarily designed for any one particular weight, but are as a rule made to handle weights within a given range, its accuracy remaining the same throughout this range. Adjustment for different weights is obtained just as in any ordinary scale, either by adding or subtracting weights from the other end of the beam, or by sliding a bob along a suitable scale. There is provided on all automatic weighing machines a small bob weight the purpose of which is to adjust the preliminary balance of the machine in such a way that when the final gate closes, the amount of material still left in the air must be added to that in the weighing bucket to actually complete the full weight.

The Swinging-chute Type

In Fig. 4 is shown a type of machine which is used for weighing packages from one to two pounds, of such material as corn meal, which it will handle at the rate of 35 to 40 per minute. It is also designed in other sizes for weighing up to 10-pound packages of corn meal, the latter at the rate of 15 per minute. With

Fig. 3. A Simple Form of Automatic Weighing Machine. Single Bucket and Drip Stream

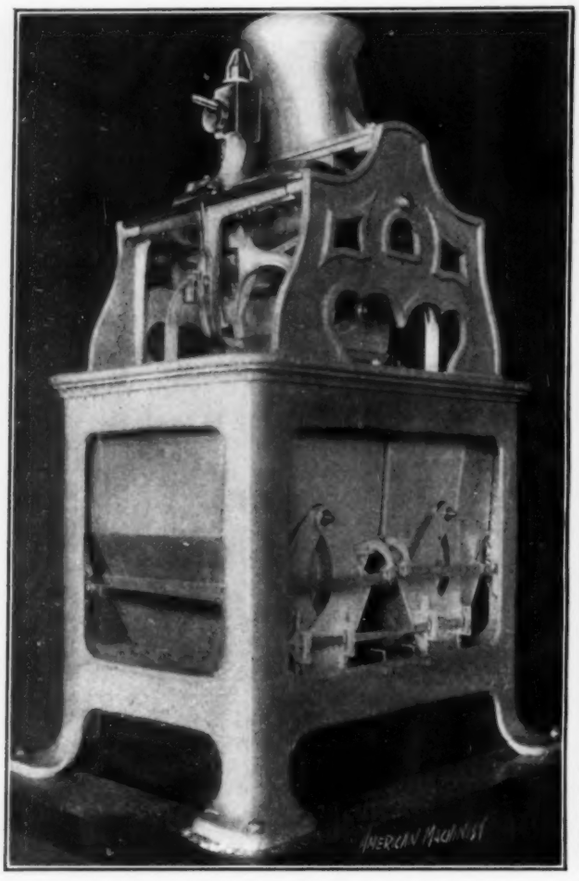


FIG. 4. TWO-BUCKET AUTOMATIC WEIGHING MACHINE WITH SWINGING CHUTE

FIG. 5. MACHINE FOR SMALL WEIGHTS WITH ELECTRICALLY OPERATED CHUTE. MECHANICAL AGITATOR OVERHEAD

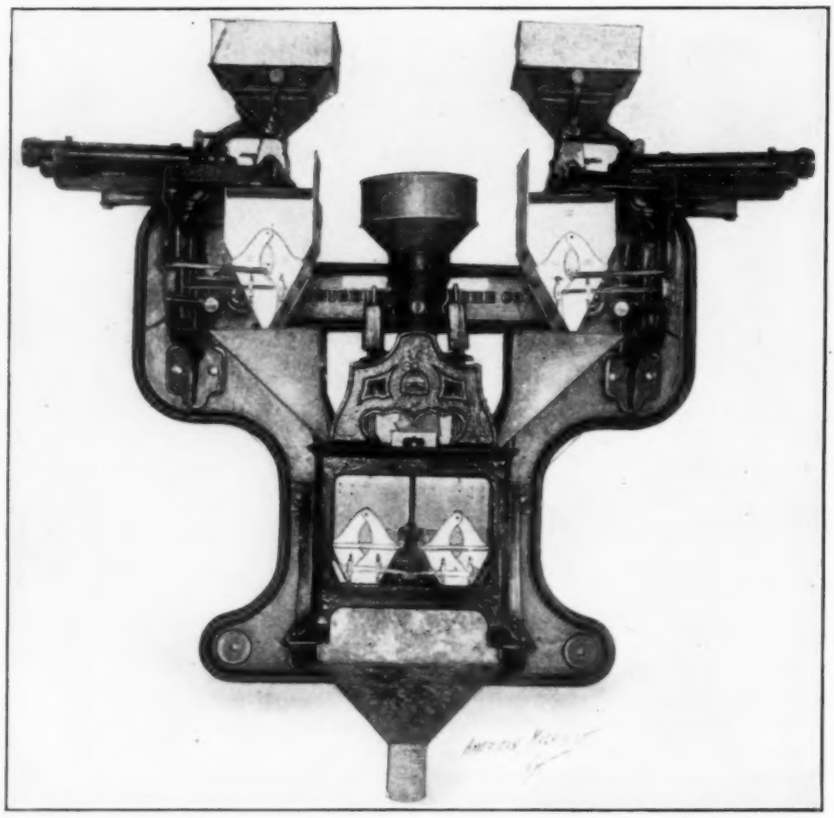


FIG. 6. MACHINE FOR VERY ACCURATE WEIGHTS. PRELIMINARY WEIGHING BUCKETS. DRIP STREAM WITH SWINGING CHUTE FOR FINAL ADJUSTMENT

this machine also, the greatest error will not be more than 1/16 of an ounce and, as before, the greatest proportion of the weights will be actual balances.

Fig. 4 shows that in this machine there are two balanced buckets and the principle of the operation is slightly different from that already described. The two balanced buckets are hung on the opposite ends of what constitutes a scale beam, and when empty they balance each other as usual. Just above these buckets is a chute which is hung on suitable trunnions so that it will swing from side to side. When swung to one side the flow of material from above is directly into one bucket and when swung to the other side the flow is transferred to the other bucket.

Above the scale beam there are two weights, one on each side, attached to the ends of two levers pivoted on the same axis as the beam, but independent of each other. Attached to the swinging chute are two latches which will hold the chute inclined to either one side or the other until the latch on that side is released. When the scale beam is normally balanced the two weights on the ends of the levers rest equally upon the two ends of the beam, tending to hold it in a horizontal position.

Suppose, for example, that the chute has been swung over to the right-hand side so as to direct the material to be

weighed into the right-hand bucket, and the chute is held in this position by the latch. When the right-hand bucket drops down, due to its load, the left-hand bucket rises and this end of the scale beam raises the lever carrying the weight on the left-hand side. This weight then acts to counterbalance the material dropping into the right-hand bucket. When, finally, sufficient material has dropped into the right-hand bucket to cause it to move positively downward, this motion releases the catch upon the directing chute and the latter immediately swings over to the left-hand side, pouring its material into the left-hand bucket. The motion of the chute is produced by the pressure of the right-hand weight, which in its turn will also act as the counterbalance when the left-hand bucket is weighing. When either bucket has completed its downward descent, suitable latches are operated which open the doors in the bottom of that bucket, dropping the material out as before. This action is continuous, first on one side, then on the other, at the speeds given, and as a rule the machine is set to weigh even quantities, that is, one pound, two pounds, ten pounds, etc.

Electric Operation for Small Weights

Fig. 5 shows a machine which is de-

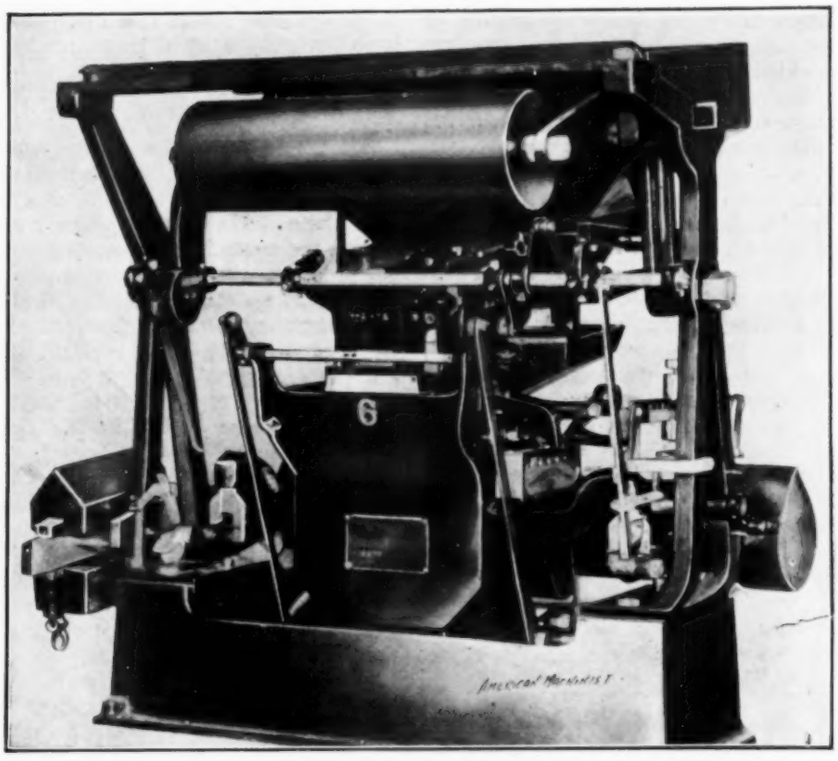


Fig. 7. Special Machine for Automatically Weighing Shot. Capacity 15 Tons Per Day. Accurate to 1/10 of 1 Per cent.

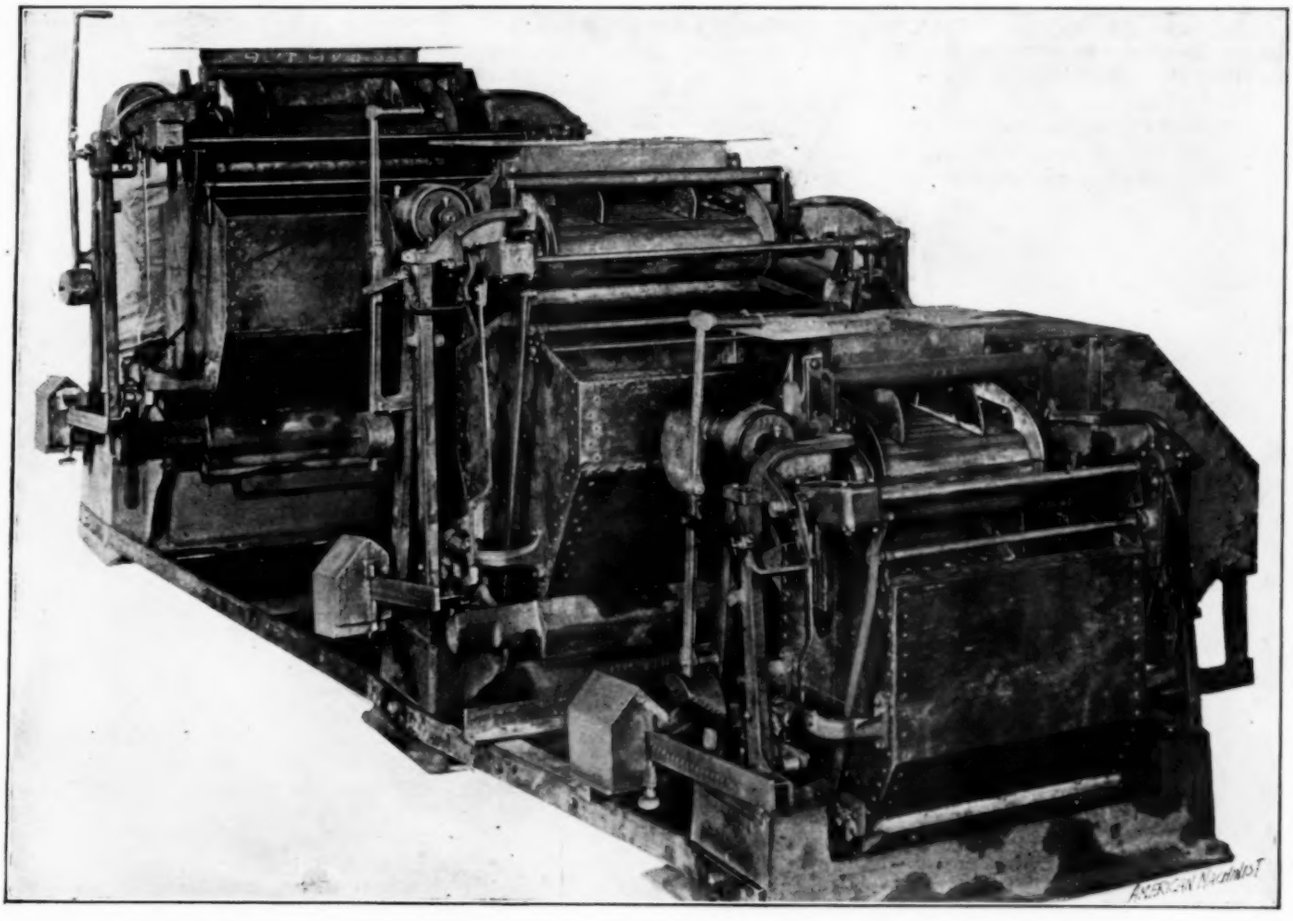


Fig. 8. Triple Weighing Machine. Automatically Weighs out Three Different Kinds of Material at One Time, Each Scale Waiting for the Other Two to Fill

signed to weigh smaller quantities of material. It will be appreciated from the description already given that the weight of the material passing through the machine acts to cause the motions of the different weights, latches, chute, etc. If, now, a machine is handling only a very small quantity of material it is not difficult to see that the parts would have to be extremely light and delicate to allow the small weight involved to do this work. The machine shown in Fig. 5 is designed for weighing spices in weights from two ounces to one pound, and in this case the energy to perform the operations comes from electricity. The construction is the same as that just described except that in this case the motion of the scale beam simply makes and breaks electric contacts to cause the swinging of the chute from one side to the other by means of suitable electromagnets. The electric circuits are positively made and broken in mercury cups, thus doing away with any sliding contacts which would introduce a serious friction element into the machine.

Machine for Great Accuracy

In Fig. 6 is shown a weighing machine for greater accuracy than any of those already described. In this case there are provided what are known as preliminary-weighing buckets. These buckets, which are the two upper ones, are of the ordinary balanced type, similar to that shown in Fig. 3, and automatically operate to weigh out about 85 per cent. of the quantity to be finally weighed and delivered. These preliminary weighings are not accurate and consequently may be performed more rapidly than usual, dropping down, one at a time, into one of a pair of lower weighing buckets similar to those shown in Fig. 4. Just above these is a swinging chute already described. In the center, a small drip stream of material is continuously passing down through the swinging chute into one or the other of the lower buckets. This drip stream adds the other 15 per cent. of the final total weight desired and at the instant that this has been reached the chute is automatically swung over to the other bucket, as described for this style of machine. The overbalanced lower bucket then opens its doors, dropping the final accurate weight of material into any receptacle below.

By this means the upper coarser-weighing devices deposit the material in the lower buckets very much faster than could be done by the small drip stream from the swinging chute, thus saving time, while the final accuracy of the weighing is insured by the smallness of the drip stream from the central source of supply. Such a machine as that illustrated in Fig. 6 is designed for handling about 25 packages per minute and will weigh within 1/32 of an ounce as a maximum error, while 90 per cent. of the weights will be actual balances. There is no electricity involved in this machine. The motions are by weights.

Weighing Heavy Materials

In Fig. 7 is illustrated a machine which is rather remarkable in that it is designed to handle very heavy material, that is, shot. Being made of lead, only a small bulk of the material to be weighed is required to give a very considerable weight, and it will be appreciated that special precautions as to head of flow and drip stream have to be taken to make this machine accurate.

This machine is of the type adopted for the heavier weights. In this case, there is but one weighing bucket, but underneath the upper chute there are the two doors, that is, the door for the drip stream and the final closing door. While the shot or other material is descending into the weighing bucket a certain portion of the weight of the drip-stream door acts to help the weight of the bucket, until a preliminary balance is obtained, causing the closing of the main door and leaving the last 15 per cent. of the weight to be made up by the drip stream. This is similar to the action of the machine shown in Fig. 3.

All latches for the closing and opening of the various doors, both above and below, are so designed as to relieve the bucket of this work as much as possible, and the latches are made with long leverages so that the pressures of the parts, one against another, are so insignificant that practically no friction interferes with the accuracy of the machine. In this device also the upper hopper is counterbalanced by a weight shown on the near side in the halftone, this balanced hopper acting to shut off the supply of shot flowing to the bottom weighing bucket when the head causing the flow decreases beyond a certain point. This, as before, is done to insure that the size of the drip stream shall be practically the same at all times. In the case of the machine illustrated the guaranteed capacity is 15 tons per day, and it is accurate within 1/10 of 1 per cent.

Weighing Three Materials at Once

Fig. 8 illustrates an interesting machine known as a triplet. It is really composed of three automatic weighing machines, each one arranged to take a different material and to weigh out a predetermined amount. As each different bucket fills up and finds its balance, it waits for the other two to receive their correct amounts. At this instant all three of the machines dump simultaneously. Such a machine will make two discharges of all three buckets each minute and with some materials can be run up as high as three per minute.

As will be seen from the halftone, the feed of the materials to the different buckets is by means of small traveling conveyers. At the time the proper balance is obtained in any one bucket this conveyer is automatically stopped and the valve controlling the material from above also closes off.

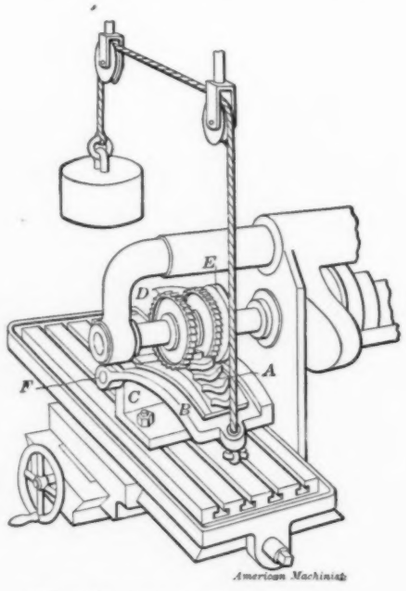
On any of these automatic weighing machines, when desired, a counting device may be attached which will add up the total number of weighings and thus the total weight handled during a given length of time.

A Turning Job on the Milling Machine

Form milling of a rather unusual kind is shown in the acompanying line cut, which roughly illustrates one operation in the shop of the Terry Steam Turbine Company, of Hartford, Conn.

The work *A*, a series of cast bronze, turbine outer buckets, partly milled out and screwed together into a curved strip, is mounted upon the arc piece *B*. *B* is hinged at the further end *F*, to the angle plate *C*, which is bolted to the milling-machine table.

At the right of the two cutters *D*, is the



Form Milling of Turbine Blades

disk of the same diameter *E*, resting upon the ridge at the right of arc piece *B*.

As the table travels under the revolving cutters and disk, the weight hanging from the rope holds the arc piece and the work up against the disk and the cutters, so that the latter cut two shoulders, or flanges along the sides of the turbine buckets. These flanges are parts of circular arcs, and the buckets are afterward mounted inside the outer shell of the turbine casing, the flanges fitting the latter, and the inside or concave surface of the strip of buckets is bored out concentric with the turbine runner, on the boring machine.

Large Belgian Norton-type Grinder

By I. W. Chubb

A grinding machine, Fig. 2, employed in the shops of H. Bollinckx, Brussels, in the production of shafts, engine details, etc., is of the Norton type, and, in fact, the Norton firm supplied the wheel

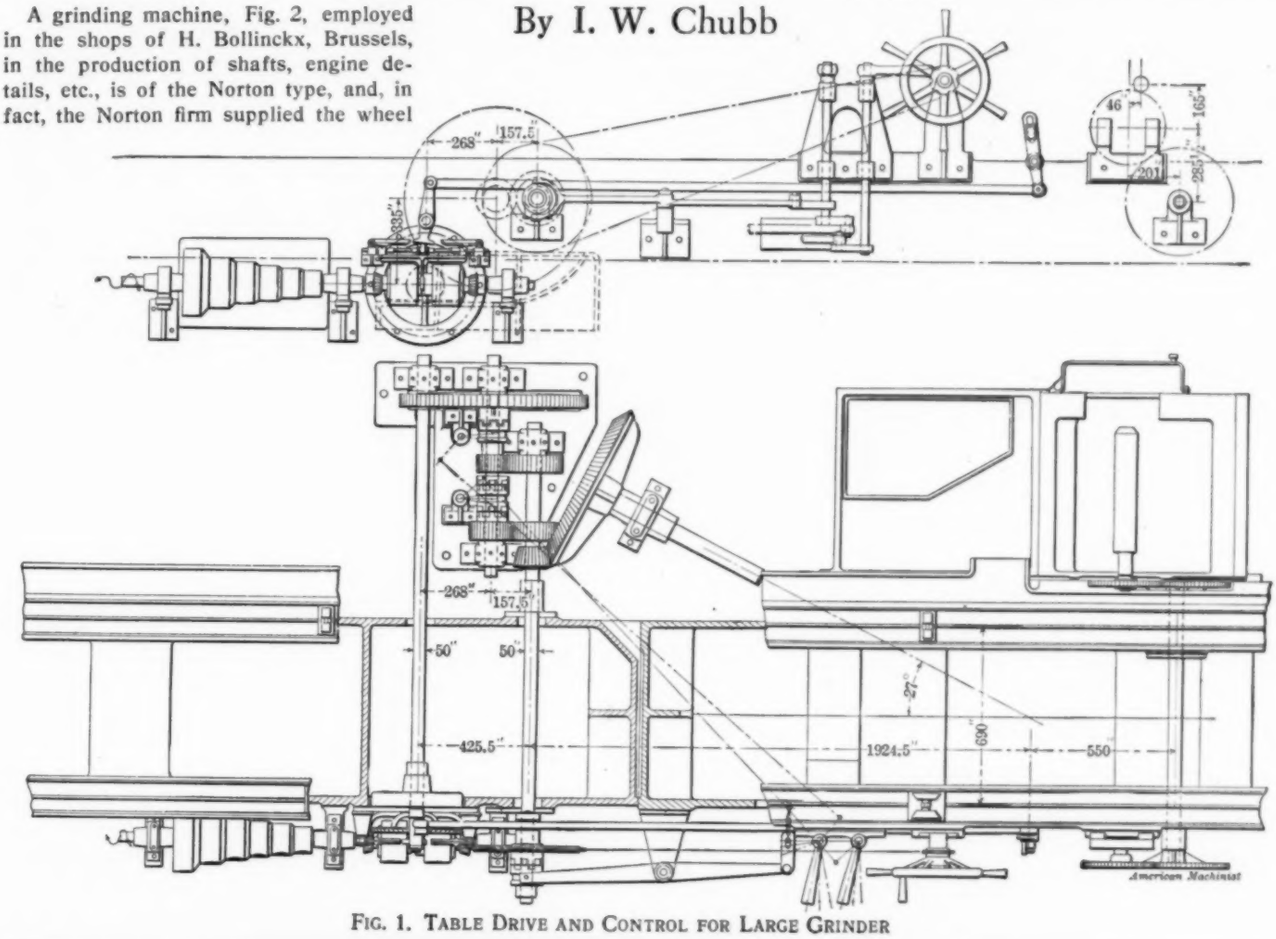


FIG. 1. TABLE DRIVE AND CONTROL FOR LARGE GRINDER

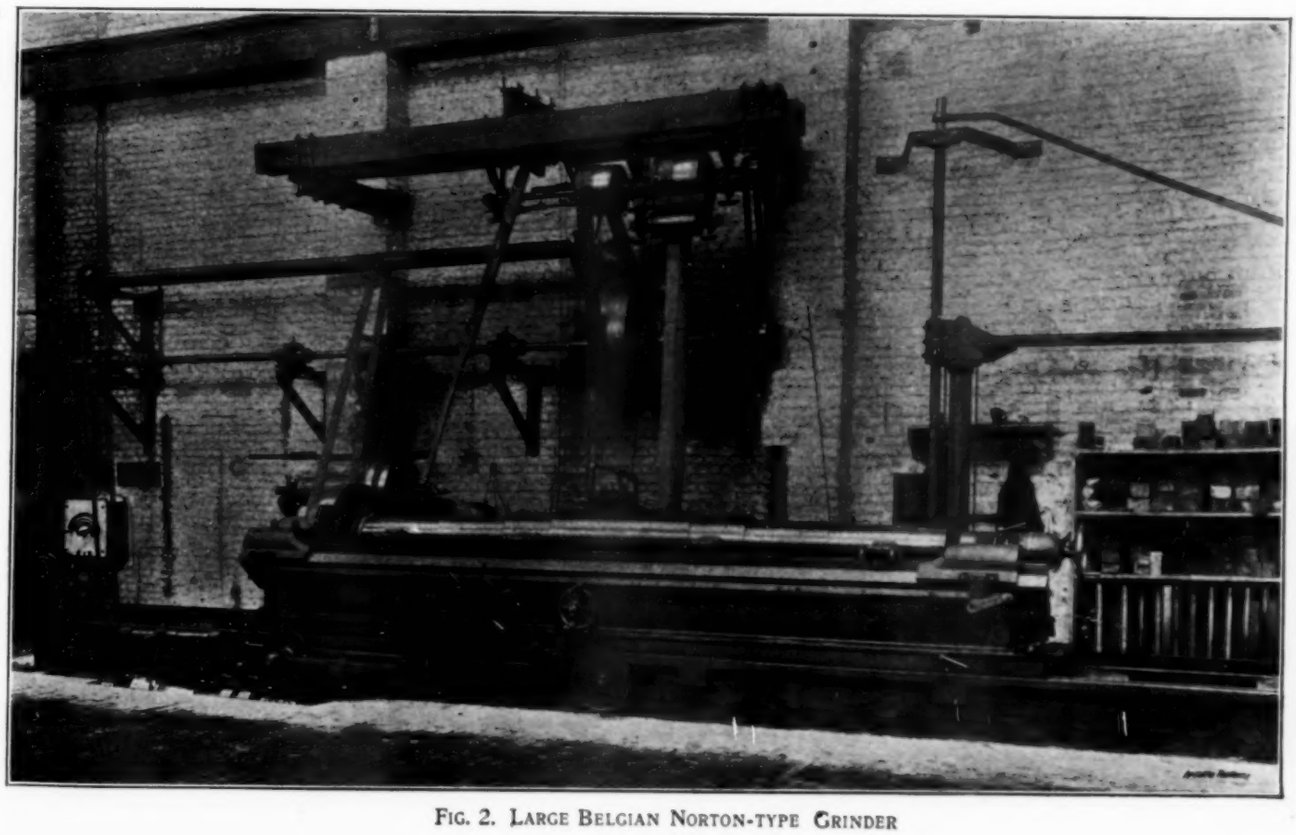


FIG. 2. LARGE BELGIAN NORTON-TYPE GRINDER

base, micrometer screw and all the gear connected with the feed of the wheel itself. The machine capacity is 5 meters (say 196⅞ inches) long by 800 millimeters (31½ inches) maximum diameter.

The Bollinckx firm themselves constructed the bed, with the worktable and the two heads carrying the job. The firm decided to follow the design of two large Norton machines which they possess. The bed, therefore, was made with a V guide on one side and a flat on the other. As the bed was 9 meters long and 690 millimeters between web centers, it had to be made in three pieces planed separately. To that end were turned at two extremities of the beds parts which served to tongue or register the pieces together, the one in the other, after planing. They served also more particularly perhaps to apply there the first two gage pieces which were planed with the bed. These were then applied to the other bed sections and served as guides for their planing. In this manner when the three parts were assembled there was very little to be adjusted.

As the firm had a large Brown & Sharpe master straight-edge, this was put on a support between the ways of the bed, and it was possible to scrape four faces exactly in a plane. In this fashion it was made certain that the flat way of the bed and the V were in correct plane. Thus with the aid of a gage and the straight-edge the slides for the table were scraped true. The same was done in regard to the carriage or worktable, which was 5 meters, 700 millimeters long.

The table movement has nothing specially remarkable except that the rack and the worm were furnished by Gray, whose machines were used for planing, and it was found that the Sellers drive system, at 27 degrees, works very well. The scheme of the belt cone and gear for drive to the worktable, together with the clutch, lever and chain system for control, will be found in Fig. 1. The stop and reverse are practically like the movements in a surface-grinding machine by Brown & Sharpe. The two heads for the work are duplicates of those of Norton machines, except that the drive is by belt and gearing instead of a belt and cone. The rests were designed by the Bollinckx firm, as shown in Fig. 3, and have given every satisfaction.

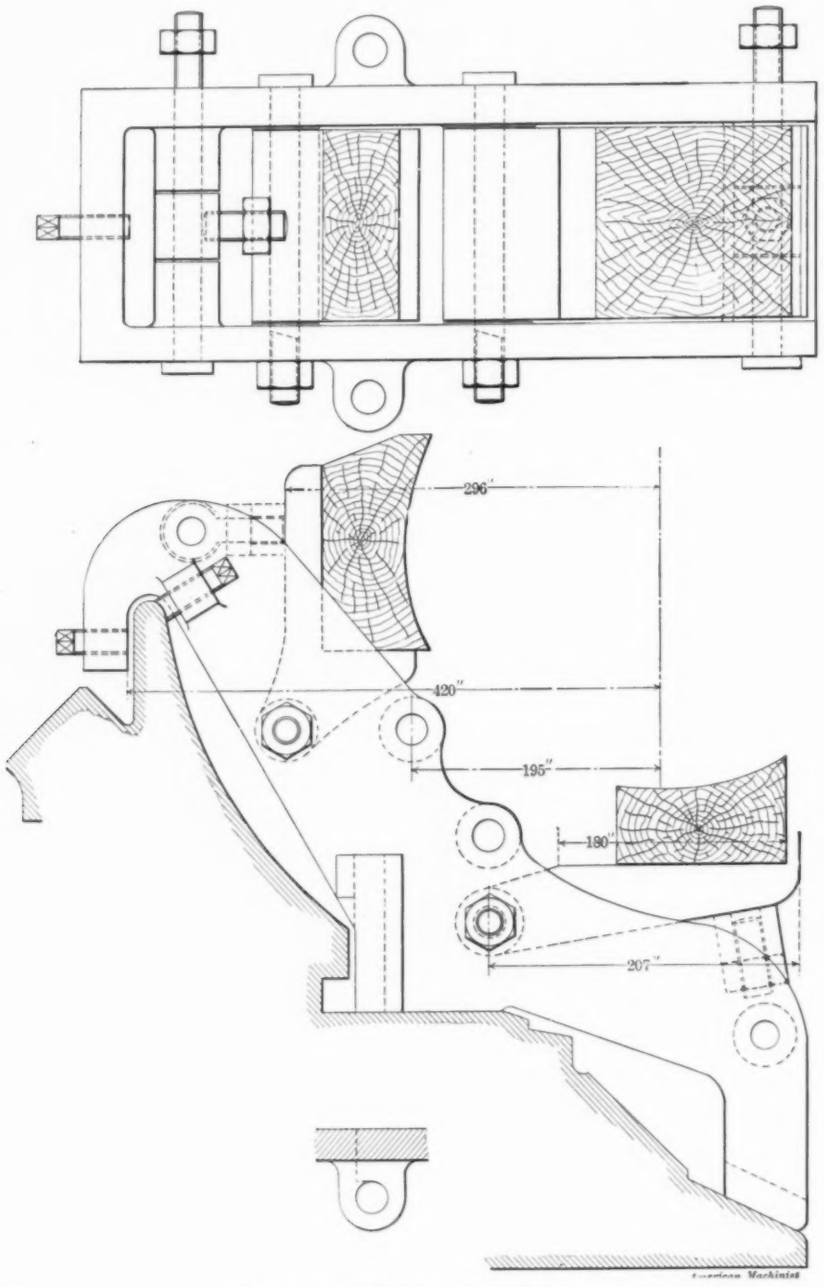


FIG. 3. REST FOR LARGE GRINDER

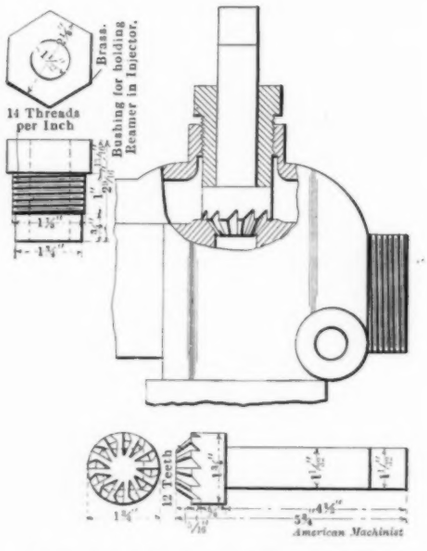
Valve Reseating Tool

BY CHARLES MARKEL

The accompanying line cut shows the reseating tool that we use at the Chicago & North Western Railway Company's shops at Clinton, Iowa. It is used on all valve seats up to 2 inches diameter, for valves on locomotives, without taking the valves from their position.

All that is required is to remove the valve bonnets and insert the reamer screw in the sleeve. This centers the reamer and holds it to the seat and a few turns of the reamer, with a wrench, will put the seat back to its original form.

You will note that this seating tool not only keeps the seat to its original angle but it also keeps it the original width, as it faces down at the same time that it makes the seat.



REAMER FOR INJECTOR THROTTLE SEAT

Pattern and Mold for Odd Shape

By Joseph G. Horner

The building of the pattern, core box and mold for an unusual shaped casting of which but one was to be made.

How the pattern and core box were designed in order to make the time and material used as low as possible.

The flask built up from three box parts and the mold made in a combination of green sand and loam with no turning over. The flat cope used and arrangements made for venting pourings.

By Figs. 1, 2 and 3 in the accompanying line cut is illustrated a casting that was built into a massive wall in a cocoa works. It was to carry heavy pillow blocks that formed bearings for sundry gear-wheel shafts. The patternmaking and molding of this were therefore interesting.

As only one was required, special flasks and expensive tackle could not be made. The nearest plain stock flasks were therefore used, and plates and brickwork improvised, as shown in the various figures. In the plan view, Fig. 3, the casting measured about 6 feet 6 inches square; and as the drawing is made to scale the dimensions of other parts may be approximately inferred. The reference letters refer to the same part in each of the several drawings.

In Figs. 4, 5 and 6 is shown the pattern in three views; in elevation, end view, and plan respectively. The plate portion *A* is built up of five strips, with open joints, and are held flush with dowel pins. Besides this it is largely reinforced by the bracket *D*. Side *B* is built up of three strips and screwed to *A*, and *C* is screwed to *B*. All are permanently fastened, that is, nothing is left loosely doweled.

Building Bracket

The massive bracket *D*, set across on *A*, is boxed up in the manner shown, which reduces the preparation of curved parts to a minimum. Two intermediate cross frames *a a*, in Figs. 4 and 6, are made of strips battened together and these are cut to the interior outlines seen in Fig. 5. These frames are shown to the right of Fig. 4. The end frames *b b* are prepared to the same outlines as *a a*, if looked at in Fig. 5.

On these frames *a a* and *b b* the lagging strips are fitted and screwed, as shown, and this gives the exterior outlines of bracket *D*. Details of these are shown to the left of Figs. 4 and 5, to illustrate the economy in the lumber used in forming the large curved portions.

Prints *E E* are formed by lagging strips that are nailed on shaped ends and screwed to the ends of *D*. On this bracket *D* the various joggles and bosses are fitted, together with their core prints for the bolt holes. On account of their length these holes are cored instead of being drilled. The entire bracket is screwed to plate *A*; the screws being put in from the opposite side of the plate for convenience of molding.

Core Box

The core box is shown in Figs. 7 and 8. Its frame is comprised of back *A*, bottom board *B*, and flat ends *C*. Inclosed by these and fitted to them are the pieces that form the ribs within the bracket, and the corresponding shapes of the prints. These extend out to the termination of the end prints in one direction, and the interior edges follow the outline of the bracket ends, as shown in Figs. 2 and 5.

The middle rib *D*, in Fig. 7, is cut to the same outline as the end ones if looked at from Fig. 8. The curved exterior of the core is struck off, guided by the edges of pieces *C C*. The shapes of the end openings *E*, corresponding with the core prints are made with blockings *E E*, Figs. 7 and 8, and are screwed and doweled as shown. The print portions of the blocking are removed to permit of ramming and replaced. The core is shown in Fig. 14.

The Mold

The illustrations of the molding and coring, Figs. 9 to 13, show the mold in its completed form. The sequence of the various stages can be understood from these; there being no turning over of the flask.

The box or flask parts are stock flask sides that were nearest to the dimensions of the casting. Three flask parts, two of them middles, superimposed, form the bottom or drag, and this was covered with a plain, flat top. Fig. 9 to 11 show vertical sections through the mold, taken at right angles to each other. Fig. 12 is a plan view of the mold with the cope removed, but with a covering plate *K* in position, and Fig. 13 shows the open mold cored up, with covering plate *K* removed to leave the interior exposed.

In the first stage of the work the box parts *F* and *G* are cottered together and laid down in a pit of sufficient depth to bring the top box a little above the floor level, for convenience in pouring. The bracket portion *D* of the pattern is unscrewed from the plate *A* and bedded in loose sand. It is then located both sideways and depthwise; the joint of the bracket *D* coming in line with the joint of box *C*.

Ramming the Pattern

The actual ramming follows. The pattern bracket is removed once or twice to permit of ramming and venting the bottom sand, after which the upper portions can be rammed around and against the pattern. The top of *D* is checked carefully with a spirit level, as the work proceeds, to see that it does not lower at any point.

Venting is done with a ¼-inch vent wire that is pushed through the sand diagonally to the box joints and to the large body of coke or cinders shown.

A main pattern runner *H* is rammed against one side of bracket *D*, as shown, and a main ingate pattern is rammed to meet it, and stands up high enough to come through the top. The sand is struck off level with the face of bracket *D*, and also the joint of the flask between *G* and *J*. The plate portion *A* of the pattern, with *B* and *C*, is now laid in position on this parting face, the bosses and facings set in, the plate removed, spaces for the bosses and facings cut out, and these rammed and leveled. The plate *A* is then returned and screwed to bracket *D*, and flask part *J* is laid in *G* and guided by its pins.

Loam Plates

While all the lower portion of the mold is in green sand, the upper sections are made in loam; it being more conveniently worked. There are two portions, that covering the entire area of plate *A*, and one vertical face of *B*, as seen to the right in Fig. 9 and in plan in Figs. 12 and 13, and that to the left of *B* and below *C*, as seen to the left in Fig. 9, and again in Fig. 12. For each of these heavy plates are cast as shown at *K* and *L* respectively. These are provided with eyes, and carry bricks, against which the loam is supported. The positions of these plates are located by means of iron stakes seen in the various views. The plates are large enough to extend well beyond the mold areas.

The main plate *K*, as seen in the sectional views, Figs. 9 and 11, and in plan in Fig. 12, is first turned with its lower face uppermost, and loamed all over. It need not be gaggered, as, being cast in open sand, it is rough enough to hold about an inch of loam. This face, when dried and smoothed, is laid on the pattern face and extends beyond its edges

on three sides to take a bearing on the joint face of the lower part of the mold. It is then staked in place. On the back of this plate, bricks *M M* are built up to within about 1 inch of the top face of flange *C*, with fine ashes in the joints. They are arranged as shown in Fig. 12.

Facing

Loam is worked in between the faces of the bricks next to the pattern and the pattern face, as shown in Fig. 12; the pattern face being first oiled. Loam is also swept over the top, level with the face of flange *C*. This loam is allowed to stiffen before removing the plate, after which the rough-loamed face is filled in with fine loam and made smooth with a trowel and rubber.

The body of bricks *N*, as seen away from the actual mold on the plate in Figs. 9 and 12, is built there to counterbalance the weight of the bricks *M* on the other side, when lifting the plate by the eyes.

Some sheets of brown paper are laid against faces *C C*. These project beyond the pattern ends to form a joint face for that portion of the mold which is carried on the other plate *L*. This plate rests directly on the joint face of the mold and is bricked over, as shown in Figs. 9, 10 and 12, and leaves space for loaming around the faces and edges of *B* and *C*. Fine ashes must be laid between the bricks for the purpose of venting. A small runner *b* is made in the loam, to come in at one end of flange *B*, and it has a vertical ingate that meets it. The pattern is removed after the loam has stiffened and the faces of the loam are filled up and smoothed over and dried.

Cope

A plain cope or top is rammed directly on the bottom part of the mold or separately. Only about one-half of the top actually need be rammed and this extends a little beyond the actual metal in plate *C*, but the whole is shown rammed in Fig. 9. The mold is then taken apart to be cleaned, blackened, and cored up. Fig. 13 shows its appearance with the principal core located and the cope removed.

The main core is shown in Fig. 14 as it stands in position for lowering into the mold. The grid on which it is built is shown separately in Fig. 15. This is cast

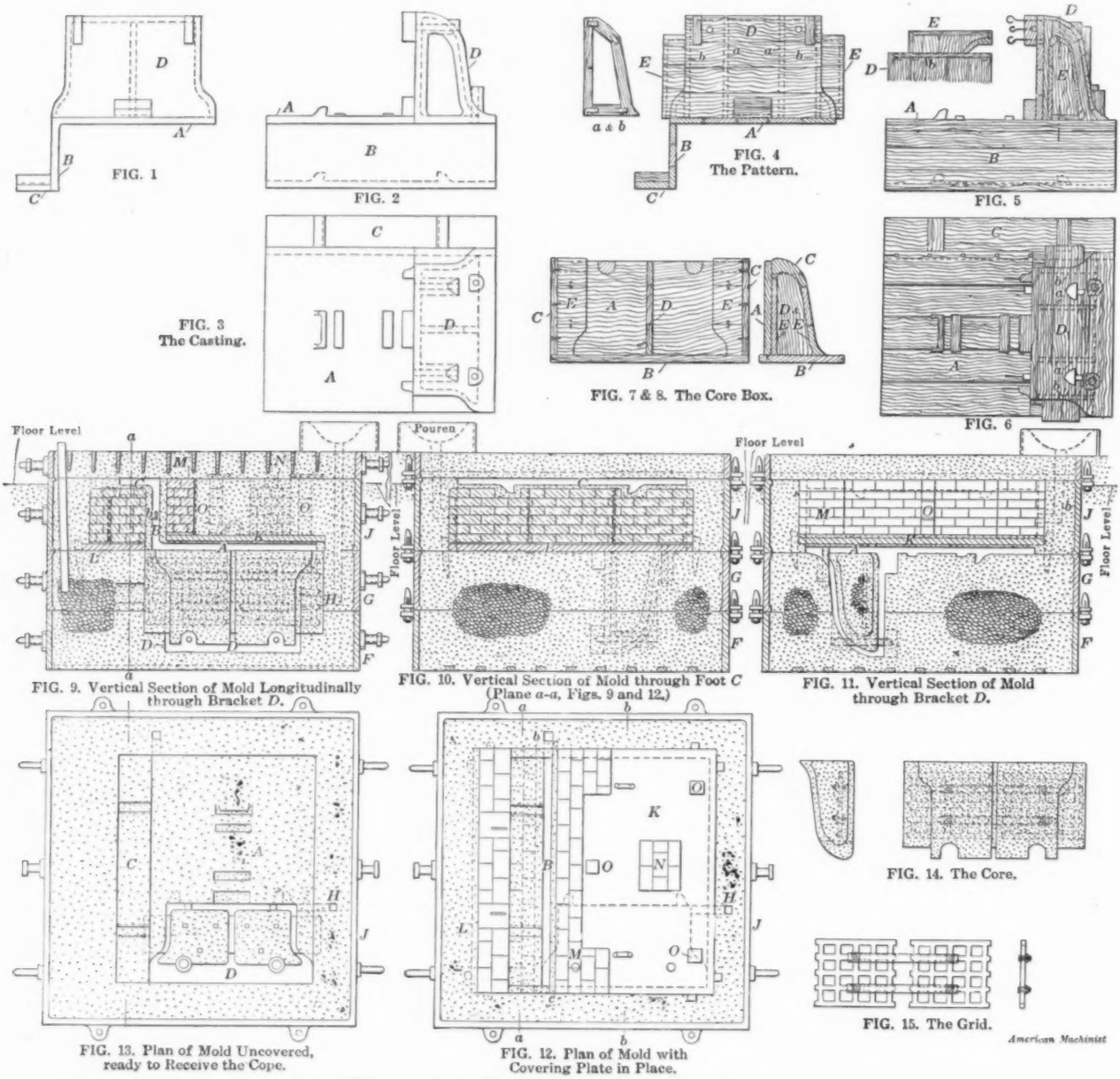


FIG. 1

FIG. 2

FIG. 3 The Casting.

FIG. 4 The Pattern.

FIG. 5

FIG. 6

FIG. 7 & 8. The Core Box.

FIG. 9. Vertical Section of Mold Longitudinally through Bracket *D*.

FIG. 10. Vertical Section of Mold through Foot *C* (Plane *a-a*, Figs. 9 and 12.)

FIG. 11. Vertical Section of Mold through Bracket *D*.

FIG. 13. Plan of Mold Uncovered, ready to Receive the Cope.

FIG. 12. Plan of Mold with Covering Plate in Place.

FIG. 14. The Core.

FIG. 15. The Grid.

American Machinist

PATTERN AND MOLD FOR ODD SHAPE CASTING

in halves and bolted together by means of two bars about ½ inch thick that pass through the middle rib of the core. This is done to facilitate the removal of the grid. The bolts are unscrewed after the core is broken out of the casting, thus leaving the grids easily removable. Small cores for bolt holes are inserted as shown in Figs. 9, 11 and 13, after which the mold is closed.

To hold the large plate down securely, the area being large and the head considerable, weights *O O O*, Figs. 9, 11 and 12, are piled up in three places, in addition to the sand which is filled in over the plate. These weights have their bearing against stiff bars that are laid across the top flask, Figs. 9 and 11.

Integrity of Tests of Metals*

A. E. Outerbridge, Jr. †

A uniform system in the treatment of metal test specimens should be adopted, for variations in treatment cause variations in the results. Again there should be a uniform size and uniform method of molding cast specimens.

*Slightly condensed from paper presented in bulletin of Franklin Institute.

†Professor of metallurgy in Franklin Institute.

There is no subject of greater interest and importance in the metallurgical arts than that of testing metals. Upon the integrity of these tests rests the stability of all the immense modern structures composed of iron, steel, bronze and other metals; human life depends in many instances upon the reliability of tests made in the laboratories of "coupons" cut from full size sections, in some cases, or from small bars—usually cast attached to larger masses—in other cases.

These coupons, or test-pieces, are supposed to fairly represent the average tensile and transverse strength, the ductility or resilience (i.e., ability to resist shock), the micro-structure of the metal and, in a word, to reveal the true physical properties of the material entering into any given structure.

Have we arrived at a degree of perfection in the art of testing metals that enables us to rely with confidence upon such records? I fear not, and I purpose herein to give briefly a few of my reasons for this somewhat pessimistic view.

So far as the development of various machines for accurately testing the tensile strength, transverse strength, torsional strains, and so forth, of metals, is concerned, a very high degree of sensitiveness combined with accuracy, has been arrived at by many constructors of such apparatus, but if the specimens tested do not in all cases fairly represent the quality of the material in the mass the records may be, and often are, misleading.

My own investigations, extending over a period of nearly forty years, have convinced me that coupons or test-pieces do not always represent truly the strength, molecular structure, resilience, etc., of the material to which they may be attached and to which they are supposed to conform closely in physical properties for the following reasons among others.

Metals in their pure state are not employed in engineering constructions, all are more or less heterogeneous compounds, or alloys, and all alloys (with perhaps a single exception, viz., gold and copper) tend to "segregate" or separate in the process of cooling from the liquid to the solid condition into richer and poorer alloys, one particular combination usually forming what is known technically as the "eutectic." For example the standard alloy of silver and copper (nine parts silver, one part copper) used for the silver coin of the United States Government and of many other nations, is, of course, prepared with the greatest care, and the molten metal is thoroughly stirred before it is poured into "ingots."

These ingots are made of the proper width and thickness to enable them to be rolled into strips from which the blanks or "planchets" for the coin are punched. If an assay be made from chips or filings cut from the center of a silver dollar and an assay also be made from chips cut from the periphery, they will not agree exactly; indeed cases have been known where the variation in "fineness" actually exceeded the legal limit of "tolerance" or allowance of variation from the standard of "nine-tenths fine."

This fact was proved by exhaustive investigations, made many years ago, which resulted in the abandonment of the old method of taking test-pieces by cutting chips from the ingots, or from the blanks, and substituting therefor what is known as the "granulation test method." After the melted alloy has been thoroughly "rabbled" or stirred, two or more samples of the liquid metal are dipped out from the pot and poured into ice water in order to cool them instantly in the form of granules. Under these conditions there is not time for segregation to occur, and duplicate samples taken from the top and bottom of a crucible containing perhaps 7000 to 10,000 Troy ounces of coin metal will agree in fineness within a few thousandths of one per cent.

In the case of the standard gold alloy for coin (nine parts gold, one part copper) no precautions of this kind are needed, for the simple reason that this alloy does not segregate, and chips taken from the edge and from the center of a double-eagle will conform to the legal requirements, notwithstanding that they are very much more strict than in the case of silver coin.

An experience of twelve years as an assistant in the Assay Laboratory of the United States Mint (1868-1880) made me familiar with these refinements in metallurgical methods of testing that have been of inestimable value in my after life, which has been devoted to testing commercial metals. The knowledge thus gained has been practically applied in various ways in connection with cast iron, steel and bronzes.

With respect to cast iron it is no exaggeration to say that the rate of cooling of gray cast iron exerts as important an influence in determining its physical properties as does variation of its chemical constituents within, of course, certain quite wide limits. If a wedge-shaped bar be cast of ordinary foundry iron, say six feet long, six inches wide, six inches thick at one end, and tapering in thickness to, say one-quarter inch thick, almost every grade of cast-iron may be found in the bar by nicking and breaking it into short sections, say six inches long each. At the thick end the fracture will be coarse grained or "open" with very dark color due to the fact that almost all of the carbon is in the graphitic or "free" condition. At the thin end the fracture will be fine grained and light in color because a considerable portion of the carbon will be chemically combined with the iron. If test bars be cut from these different sections, it will be observed that the coarse-grained metal is very soft under the tool, while test bars cut from near the thin end will be very hard to turn. Between these two extremes the metal will have intermediate degrees of hardness and of coarse grainedness.

If tensile tests be made from different portions of the casting, it will be found that the strength varies with the structure through an enormous range, as much as 100 per cent. gain often occurring in one portion over another. If the ordinary foundry iron used for the wedged-shaped casting be low in silicon (say 1 per cent. or under) the thin end of the wedge will be as white as silver, as hard as steel and as brittle as glass, because a large proportion of the carbon will then be in the combined form.

I have before me two test bars of soft foundry iron used for casting light pulleys, poured from one small hand ladle of iron into companion bars of the same

size, viz., 1 inch by 1 inch by 15 inches; one bar was cooled normally in the green-sand mold, the other was cooled very rapidly indeed. Both bars were broken transversely on an ordinary transverse testing machine, using a span of 12 inches. One bar, cooled normally, broke under a strain of 2000 pounds (round figures); the other, cooled rapidly, at 4000 pounds exactly. One-half of each bar was then used for tensile tests, being turned to the same dimensions and pulled upon a 100,000-pound hydraulic testing machine. The bar cooled normally showed tensile strength of 21,500 pounds per square inch. The bar cooled rapidly showed tensile strength of 37,000 pounds per square inch. These particular tests were made twenty-two years ago and the results have been corroborated many times since then, also valuable practical use has been made continuously from that time of the knowledge thus gained of the remarkable effect of controlling the cooling of castings of non-uniform sections.

In a paper giving some of the foregoing facts, read before the American Society for Testing Materials in 1903, published in the *Proceedings*, Volume III, page 216, the following conclusions were drawn:

"The rate of cooling of cast iron from the fluid to the solid state is such an important factor in determining the physical properties of the metal, that it is just as necessary to know the dimensions of the test bars as it is to know the chemical composition. For the same reason it is equally desirable that standard sizes of test bars should be adopted, which would be suitable for different grades of iron."

It is pleasing to note that the American Society for Testing Materials has, through one of its sub-committees, been endeavoring to bring about uniformity of methods of testing, not only between different manufacturers in the United States, but also in Europe as well, with indications of a successful issue in time.

Castings of iron and other metals are frequently made for the Government as well as for private engineering firms under specifications which sometimes tax the ability of the founder to meet pretty stiff requirements as to strength. In the absence of any specific rules as to the method of molding the test bars or coupons, or even as to their size, the temptation to a foundry foreman, who may have practical knowledge of the facts here noted, to "jockey" with the test bars and thus insure that they will fully meet the requirements, is very great, and ought not in the interest of all to be continued longer.

There is still another method, now pretty well known, by which the transverse strength of cast-iron test bars can be increased from 25 per cent., even up to nearly 50 per cent., without either rapid cooling of the metal or making any change in method of molding. Instead of simply brushing off the loose sand from the test bars with a wire scratch brush if they be placed in a "tumbling barrel," commonly employed in foundries for cleaning castings and tumbled about therein for a couple of hours, they will all gain largely in transverse strength due, it is thought partly, if not mainly, to the rapid release of "cooling strains" caused by shocks, and it has long been known that iron castings improve in strength with age, due to gradual release of internal strains. When these peculiar observations were first made known, the custom of cleaning the sand from test bars in the tumbling barrel became very popular indeed and finally a few years ago the American Society for Testing Materials found it desirable to incorporate a special clause in its new specifications for cast iron that test bars must not be tumbled or otherwise subjected to mechanical shocks or vibrations before being broken. This was a gratifying tribute to the original discovery.

On the occasion of a visit to a large manufacturing establishment some time before this restricting clause was adopted I noticed that all of the cast-iron transverse test bars had been put through the tumbling mill "to clean them" as I was informed by the boss.

With regard to test bars for bronze castings, similar restrictions should apply in regard to cooling, for segregation occurs in all commercial bronzes, depending largely upon the rate of cooling from the liquid to the solid state. This segregation changes the molecular structure and affects the tensile strength of the metals. Coupons or test pieces of bronze cooled much more rapidly than the castings to which they may be attached do not reveal the true character of the fracture, or the real strength of the metal. On the contrary they present to the eye a finer-grained, more uniform metal and show abnormal strength in the testing machine. Very recently indeed my attention was called to a novel application of this fact by noticing some rather high tensile tests of test bars attached to some important castings made of a special bronze. The fracture of the test pieces was exceedingly fine grained and showed an absolutely uniform or homogeneous structure. On examining very carefully some of the castings with the test bars still attached, it was plainly to be seen that they were poured under very different conditions from the castings themselves, the test bars being cast into iron molds so as to solidify them instantly, while the casting to which they were joined were made in ordinary sand molds.

Test bars thus doctored are, in my judgment, far worse than useless, since they give the purchaser of the castings, who has taken the precaution (involving some trouble and expense) of turning and testing coupons, a false record of the character of the metal in his castings.

Apropos of this, I will venture, in conclusion, to refer to my short paper entitled "A Study of the Micro-Structure of Bronzes," printed in the *Journal of the Franklin Institute*, January, 1899, in which appear a number of photomicrographs of specimens of bronze metals (ninety were used in the investigation) cast in sand, and one representing a U. S. cent in which the crystals are very much finer and the metal is apparently more homogeneous, for there is an absence of the irregular bands of the eutectic alloy so conspicuous in all of the other bronze specimens. It was stated that: "This is perhaps partly owing to the fact that coin ingots are always cast in iron molds and the metal is thus suddenly solidified while all of the other specimens were cast in sand molds. This observation may have practical value."

The conclusions drawn from these investigations with bronze metals were quite similar to those already noted with respect to investigations in cast iron, and are as follows:

1. Variations in treatment of specimens cause variations in the results, which may be misleading, and it would, therefore, seem desirable that some uniform system should be adopted by all investigators in this field.

2. The rate of cooling of a mass of metal affects the micro-structure so that two specimens from the same ladle of metal, one taken from a small casting quickly cooled, the other from a large casting slowly cooled; or two photomicrographs taken from different portions of the same specimen, may show variations in micro-structure that may lead to error.

It is desirable, therefore, that some uniform size of specimens (and uniform method of molding) should be selected by micrometallurgists as a standard with which to make comparisons.

The actual case cited here, where bronze castings were made in sand molds subject to slow cooling, while the attached coupons for testing were made in iron molds to insure rapid cooling, coming to my notice only a few days ago emphasizes the importance of some concerted action in accordance with the foregoing suggestions looking toward adoption of standard methods for testing metals, and for insuring the integrity of such tests.

Numerous other illustrations might be drawn from my own daily experience and observation, but I think enough have been given to establish a good case.

In a paper presented before the American Society for Testing Materials, dealing with cupro-nickel steel, it is noted that alloys carrying from 5 to 20 per cent. copper, which without nickel would be extremely hard and brittle become, by the addition of nickel in proportion of 20 to 50 per cent., highly ductile and easily machineable.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print is good enough to pay for. The value is in the idea—not the length of the letter.

A Plate Vise

A plate vise for use in conjunction with any ordinary bench vise, when surfacing up thin gage plate, is certainly of great value in any toolmaker's kit, and the one here shown and described is a great improvement upon the usual design seen in the majority of shops. Fig. 1 shows two views of plate vise. Fig. 2, gives the component parts in detail and consists of:

A: Top plate of cast steel, ground on both sides and slotted out for passage of jaws. Also drilled and countersunk for 4 screws to bind to angle plate.

B: Back, or traveling jaw. Tool steel, slotted for passage of sliding rivet and drilled for fixed rivet. Jaw end hardened and tempered.

C: Front, or fixed jaw. Slotted for sliding rivet, drilled for stationary rivet, and also drilled and tapped for hight adjusting screw.

D: Angle piece. Tool steel, slotted for fixed jaw, and drilled and recessed out for adjusting screw head. Also drilled and tapped for screws to secure to plate.

E: Tension springs.

F: Lattice distance bars. Machine steel, drilled for three rivets, all from same centers, and well countersunk one side.

G: Rivets for back, or movable jaw; one short and one long M. S.

H: Rivets for fixed jaw, M. S. Ends grooved to hold ends of tension springs.

J: Hight adjusting screw. Tool steel.

K: Rivets for center holes in *F*. M. S.

L: Washers, M. S., to go over rivets and under outside lattice bars.

The springs keep the jaws apart to their utmost capacity, which is as far as the slot in plate *A* will allow.

When used in bench vise, the jaws close in parallel and are very sensitive to pressure of bench vise. Jaws are adjustable to hight for different thickness of plate.

Plumstead, England. H. HARRIS.

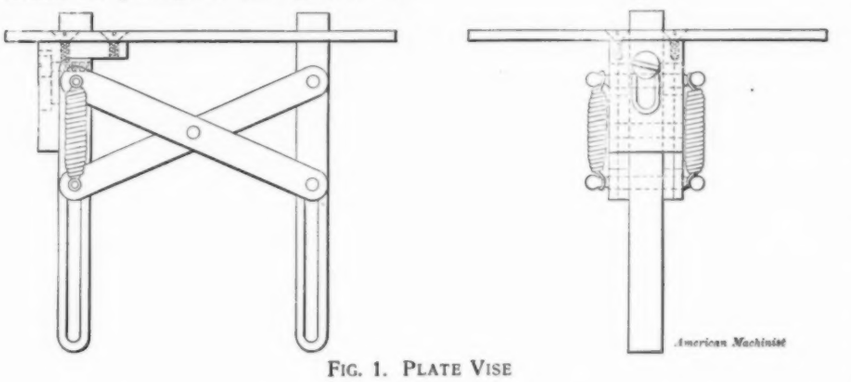


FIG. 1. PLATE VISE

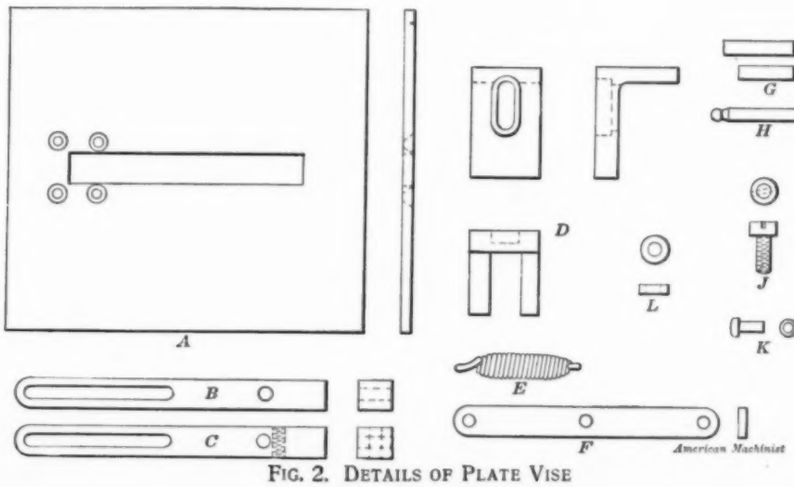
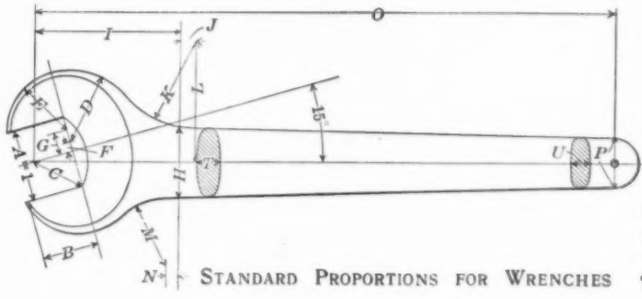


FIG. 2. DETAILS OF PLATE VISE

Standard Proportions for Wrenches

Wrenches are something every man who follows the machinists' trade uses and uses often, yet a very small percentage of machinists today can lay out offhand a wrench of acceptable proportions and strength. With the accompanying drawing and tabulated proportions any mechanic can in a short time lay out a good wrench. The proper proportions are all embodied to make a wrench that is mechanically and theoretically what it should be and the same is true if the wrench is the size it appears in the sketch or if it is a wrench five times as big.



STANDARD PROPORTIONS FOR WRENCHES

Opening of Jaws taken as constant = 1			
A	= 1	*J*	= 3/10
B	= 3/4	*K*	= 1 1/4
C	= 5/8	*L*	= 1 11/13
D	= 1	*M*	= 7/8
E	= 15/16	*N*	= 3/16
F	= 1/8	*O*	= 8
G	= 5/32	*P*	= 11/16
H	= 1	*T*	= 5/16
I	= 2	*U*	= 1/4

Thickness of Jaws = 1/2

Remembering that the distance across the flats of any nut of a given diameter is for finished nuts, $1\frac{1}{2}\ D + \frac{1}{8}$ inch, then the sizes for a wrench to fit a 2-inch nut will be as follows:

$2 \times 1\frac{1}{2} = 3$ inches;

$3 + \frac{1}{8} = 3\frac{1}{8}$ inches

distance across flats or the opening of the jaws, or *A*.

B then $= 3\frac{1}{8} \times \frac{3}{4} = 2\frac{11}{32}$ inches;

C then $= 3\frac{1}{8} \times \frac{5}{8} = 1\frac{31}{64}$ inches;

D then $= 3\frac{1}{8} \times 1 = 3\frac{1}{8}$ inches;

E then $= 3\frac{1}{8} \times \frac{15}{16} = 2\frac{29}{32}$ inches;

and so on down the complete list. With the list thus reduced to tangible figures and all the proper centers and radii laid off, it is a simple thing indeed to complete the work.

These data were collected by a careful comparison of all the different size wrenches made by the best wrench makers of America and reduced to this simple form.

It is well for the machinist always to remember that for cold-pressed nuts both hexagon and square, the wrench that fits them is $1\frac{1}{2}$ D + $\frac{1}{8}$ inch where D = diameter of bolt and for hot-pressed nuts $1\frac{1}{2}$ D + 3/16 inch. This refers to the jaw opening.

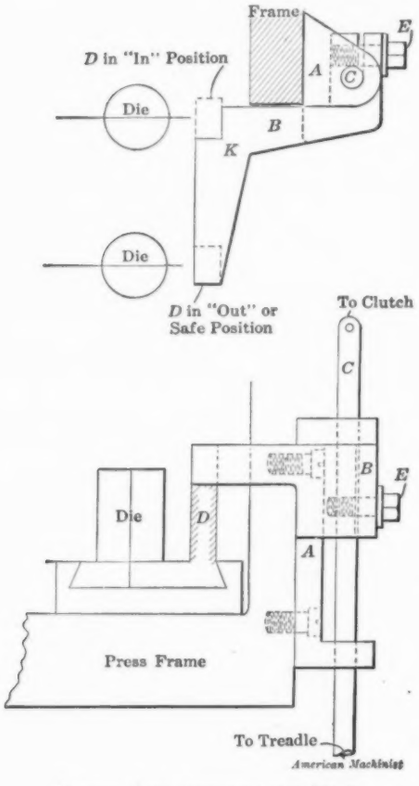
The angle between the center line of the shank of the wrench and the jaws is 15 degrees for wrenches used on hexagon nuts and $22\frac{1}{2}$ degrees when the wrench is designed for square nuts only.

The 15-degree angle is the best, as it facilitates the use of the wrench in close corners where straight wrenches cannot be used.

Vallejo, Cal. FRANK S. BUNKER.

Safety Attachment for the Punch Press

The sketch shows a safety arrangement used by us in connection with a sliding



SAFETY ATTACHMENT FOR PRESS

die. Its object is to prevent the press being tripped before the die is in proper position, thereby saving greatly on the tool expense. It works as follows: The bracket A, which is fastened to the side of the frame, supports the rod C, one end of which is connected to the clutch, the other end to the treadle. On this rod the finger B is clamped by the screw E. D is the stop. The shape of the finger B should be such that when the die is in its proper working position the notch at K allows the stop D on the die slide to free the finger B so that the treadle may be operated. When the die is not in its working position, it is impossible to operate the treadle, there being only a sliding fit between the top of stop D and bottom of finger B. We have had no trouble since applying this stop, which we use principally on bench presses.

Bridgeport, Conn. M. O. DEAN.

Making Small Wood Rolls

A short time ago we had an order for 2000 maple rolls like Fig. 3, with a steel-shouldered stud like Fig. 5.

The maple-wood blanks came cut in disks with 1/16 inch left for finish all over.

The studs, Fig. 5, were made in two operations on the screw machine of $\frac{3}{8}$-inch bar stock.

The rolls were made also in two operations. At the first operation the blanks were put into a 3-jaw chuck and a $\frac{3}{8}$-inch hole drilled, after which the turret tool, Fig. 6, was brought up and with the tool, Fig. 7, the recess E was formed; in this operation the steel bushing D, Fig. 6, was removed, the face J was then squared with a tool in the tool post.

The steel studs, Fig. 5, were then driven into the rolls.

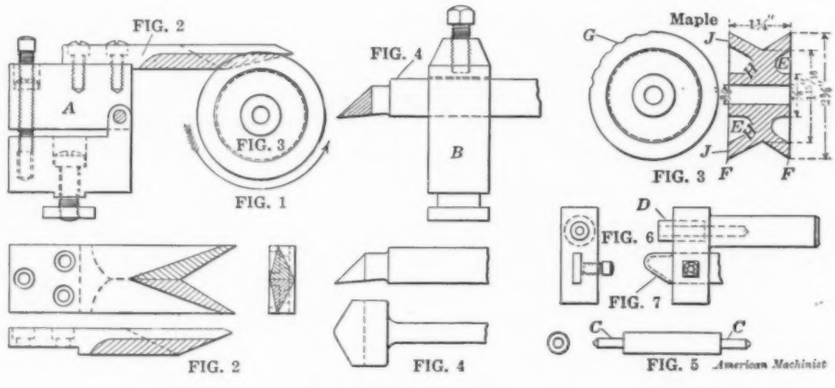
In the second, or finishing operation, we encountered trouble, as our intentions were to use a roughing and finishing tool like Fig. 4, but in so doing, and in our haste to accomplish results, the edges F, Fig. 3, shown better on plan view, would invariably chip off, leaving the edge as shown at G, so the tool, Fig. 2, and holder A, Fig. 1, were adopted, which proved excellent, as we could push it rapidly across the face of the roll and the V-shape made a nice shear, giving a very smooth job.

For the second or finishing operation the 3-jaw chuck was removed and a 3/16-inch screw-machine spring collet, put in the machine with a special face plate screwed onto the bonnett, which had two pointed pins to come in contact at H of the recess E, Fig. 3. which, of course, drove the roll and kept it from slipping on the stud, Fig. 5, when the groove was being operated on.

The rolls having the studs inserted, the stud was put into the spring collet and a special stop in the turret brought up against the face of the roll forcing it onto the pins of the face plate. The tool Figs. 6 and 7, was brought up and the recess E cut. With part C of the stud, Fig. 5, still in the hardened bushing D, Fig. 6, to steady the roll, the groove was finished with the tool, Fig. 4, as a rougher and Fig. 2 as a finisher.

The face J was also finished with a wide flat tool inserted in a holder similar to Fig. 6, which was also held in the turret head.

Lowell, Mass. J. S. SCOTT.



TOOLS FOR WOOD ROLL

Finding the Half of an Odd Number and a Fraction

An easy and very useful scheme for finding the half of a number consisting of an odd number and a fraction, is as follows:

For example, the half of 7 13/32 is required. At a glance it is seen the answer will be 3 and a fraction. The numerator of this new fraction will be equal to the sum of the numerator and denominator of the given fraction, as; 13 plus 32, or 45. The denominator of the new fraction is found by multiplying the denominator of the given fraction by 2, as; 32 times 2, or 64. Thus, the final answer of 7 13/32 ÷ 2 = 3 45/64.

This method holds good, whether there are one or more figures in the whole number. In the same way, 15 17/32 ÷ 2 = 7 49/64, or $117\frac{7}{8}$ ÷ 2 = 58 15/16

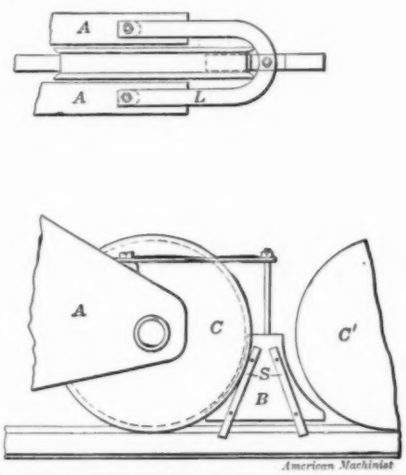
and so on; taking but a moment's thought when you know how.

The use of this scheme will be found very convenient in the drafting room, when such dimensions are required to be laid off equally distant from a center line.

Philadelphia, Penn. FRANK J. SEPAS.

A Safety Kink for Traveling Cranes

On large installations of a type of overhead, traveling, electric cranes, whose design is such that the main wheels supporting the bridge upon the runway must take the entire shock in case of collision between two cranes, considerable trouble for the repair man sometimes develops, as the impact of two such machines, weighing from 40 to 50 tons each, is frequently sufficient to break off the flanges



BUNT BLOCK TO PREVENT BREAKAGE OF CRANE WHEELS IN COLLISION

from the wheels. Even when the collision seems slight, this may occur to a great enough extent to necessitate the replacing of some one or more of the four wheels in contact.

In a large shop, where several cranes are often operating close together, upon the same runway, the operators are sometimes excusable in case of a collision, as their whole attentions may be demanded in the making of a ticklish "lift" on the floor, 50 feet below, and no human being can always watch all points at once. Under such conditions the cranes may be occasionally expected to collide with rather disastrous results.

In a plant where some fifty such cranes are in constant daily operation, the repair foreman, after considerable worry and work in keeping the cranes in service, finally devised the safety bunt block shown in the accompanying sketch. *A* is the frame of the crane, carrying the traction wheels and safety device. *C* and *C'* are the wheels of two cranes about at the point of collision. *B* is the bunt block, made of hard maple, sawed to a slightly larger circle on its "business edges" than the treads of the wheels.

This block is supported from the frame as shown, by the ¼x2-inch iron loop *L*, and a bolt, and is protected from splitting by four iron straps *S*. These straps, two on each side, also prevent the block from turning sideways, as they straddle the rail on the runway. The grain of the wood must run horizontally to prevent splitting when the device is in heavy use.

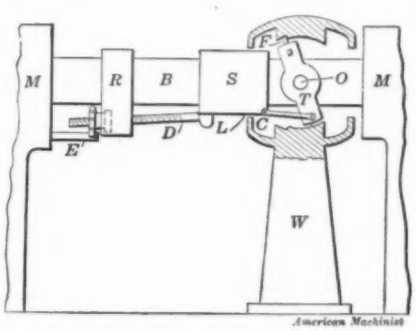
When in normal position, the block clears its crane wheel and the runway by about half an inch. When called upon to act, the block comes to rest upon the runway, due to the springing of the loop *L*, and being slightly larger in diameter on its working edges, than the crane wheels, tends to lift the latter slightly from the runway, thus stopping them more quickly, and in complete safety. As the cranes separate, the device automatically returns to its normal position, and once more has averted an annoying accident.

This attachment has been in use in the present plant for two years and has never failed to perform its function properly. It has the advantage of allowing the operator to concentrate all his attention on the work below, secure in the knowledge that his crane cannot be injured by any ordinary collision, and this little device goes a long way toward insuring satisfactory operation of heavy cranes.

Milwaukee, Wis. H. B. MCDERMID.

Boring Seats for Spherical Bearings

In order to allow a shaft bearing to perfectly aline itself in a vertical plane, and especially to provide for the shaft defection sometimes present, it is customary for some designers to use a



BORING SPHERICAL BEARING SEATS

spherical seated shell. In this way undue friction and excessive heating are avoided. As the operation of boring the enveloping pedestal is somewhat unique, it may be interesting to some of the readers of the AMERICAN MACHINIST to see one method of doing this work.

Referring to the sketch, *B* is a standard boring bar carried in supports *M M*, and having mounted upon itself the sliding sleeve *S* and the stationary ring *R*. To the bar is also attached the swiveling ring *T*, which swings about the point *O* and carries the tool at *F*. This ring *T* is connected by a link *C* to the sleeve *S*, which is fed along the fan by means of the screw *D* and the common star feed *E*.

In operation, it is, of course, necessary that the point *O* be centered exactly with the work *W*, so that the seat may have its largest diameter on the center line of the pedestal.

In cases where the clearance at *L* is sufficient, the screw *D* may be attached directly to the swiveling ring *T*, thus dispensing with the link *C* and sleeve *S*. The combination of the two devices is used for all bearings of this class in a shop where hundreds are machined every year and where the greatest diameter of the seat varies from 8 inches, to the heaviest now built for power-plant machinery. The scheme has proved very satisfactory for that class of work.

Milwaukee, Wis. H. B. M.

Charles T. Porter—A Tribute

I feel impelled to offer my word of tribute to the memory of Charles T. Porter. The rushing world had, in a way, swept past him. He belonged to the Nineteenth rather than the Twentieth Century, and was no longer under the spot light. And yet he was undoubtedly one of the world's great engineers and had been especially an epoch maker in engineering progress.

Last year he was the fifth one to receive the John Fritz medal " for notable scientific or industrial achievement." This honor had been eminently well bestowed in each case and the latest recipient was in no way less entitled to it than any of his illustrious predecessors. The general uptodate public perhaps knew his name somewhat less familiarly than it knew the others, but the engineering world knew him well, although few after all, realized the magnitude of the world's indebtedness to him.

The formal award of the John Fritz medal in Mr. Porter's case was for his work in the development of the modern high-speed engine. He revolutionized steam engineering, and the later developments of the power house, and the special applications of steam in the rolling mill, in marine service, in the vast electric field, and practically wherever steam is employed for power development, were led up to and made possible and actual by him.

And all this came not as the result of a single happy thought or of one great invention, but from a changing and adapting and originating of many details.

The original Porter-Allen high-speed engine was not an invention but an aggregation of inventions, and in its designing the inventive faculty was constantly alert and resourceful. There was novelty of invention in the valve, in the valve motion and in the governor. The frame and bearings were novel and original. The making of the reciprocating parts very heavy instead of light was, at the time, perhaps, the most astonishing feature of all. For the original and independent inventions involved, Mr. Porter was always careful to insist that Mr. Allen should have full credit.

Not only was the inventing and designing task most exacting, but the requirements of construction were little less so. High-speed engine practice produced a revolution also in shop practice and Mr. Porter became a pioneer in precise workmanship as it is known today, not only insisting upon minute accuracy and finish, but also devising the ways and the means for such production. While the modern, precise methods of manufacture, and the almost absolute identity of parts produced cannot be credited to any one or any dozen selected men, Mr. Porter was among the first and most insistent and most successful of modern manufacturers, and in his line no more excellent workmanship has ever been achieved. Mr. Porter not only thus taught the tricks of high speed and of precision in manufacture, but he pushed others, no doubt often unknowingly, to notable engineering and manufacturing achievements.

As another consequence of high-speed engine developments and requirements, Mr. Porter became the begettor of the first efficient and satisfactory high-speed steam-engine indicator, he having stimulated Charles B. Richards to its production, and then Mr. Porter's book in exposition of the indicator and of indicator practice brought out his remarkable talent as a clear and forcible and most readable writer. My first acquaintance with that book worked a new departure in engineering knowledge and imparted an interest in steam engineering never known before.

Mr. Porter's high success in so wide a reach of activity is most unaccountable, according to the story which he has told us. His early predilections and associations do not seem to have been at all in mechanical or engineering lines. I tried more than once to learn from him something of his early years, but without success. He was educated and prepared for other things and had begun life as a fully equipped lawyer, when directly through that he was brought face to face with his life work, so different, but which he would seem to have plunged right into without any of the usual time serving or ordeal of preparation.

If his success was so unaccountable, his unsuccess in securing any of the substantial rewards of life for which man strives would seem to be not less so. One might have thought that in this the legal training and experience should have helped him, but it seems not to have availed at all.

I knew Mr. Porter only for a score of years, and after, as we may realize now, all his notable things had been done, although his head was full of schemes. It was always a pleasure to meet him. He was genial and helpful and always highly appreciative of every little thing that could be done or said in evidence of one's well-wishing. He did much good work, which is enduringly embodied in the world's engineering history.

New York. FRANK RICHARDS.

Making Eccentric Spindles for Automobiles

The first operation is simple, being concentric; it is produced from the bar on a hollow spindle lathe. Fig. 1 shows the operation of turning eccentric pin; this is done by means of a special chuck, sketch explains method.

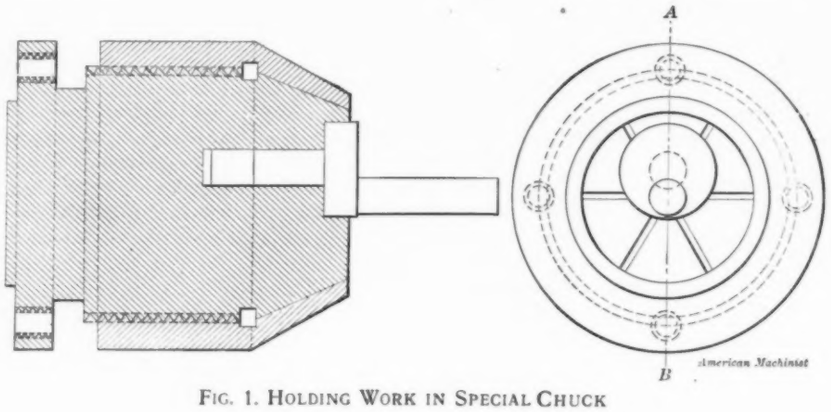


FIG. 1. HOLDING WORK IN SPECIAL CHUCK

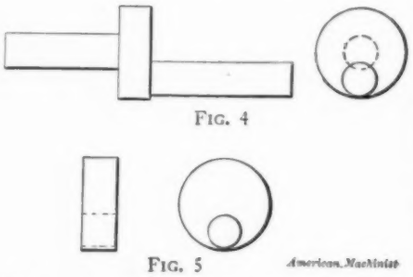


FIG. 4

FIG. 5

FIG. 4. COMPLETE ECCENTRIC SPINDLE
FIG. 5. COLLAR

The internal part of chuck is split into six sections, cut far enough back to allow paws to catch the spindle. The collar is inserted into recess, and this becomes the driver. The outside collar is then screwed up by means of holes drilled in periphery.

Blank pieces are cut off bar in turret lathe, same diameter as collar of spindle. These are drilled in drill-jig, as shown in Fig. 2.

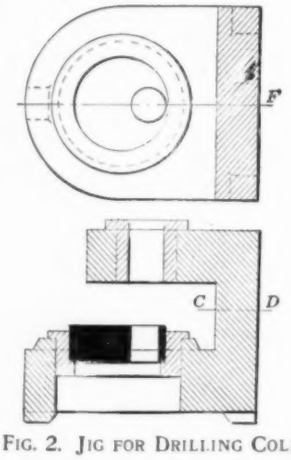


FIG. 2. JIG FOR DRILLING COLLAR BLANKS

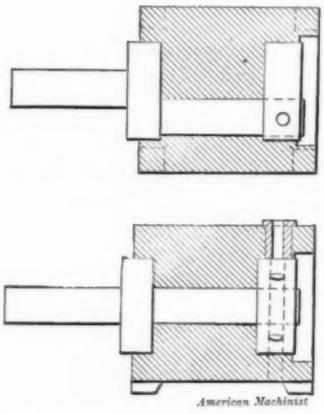


FIG. 3. DRILLING PIN HOLE

Fig. 3 shows method of drilling pin hole by means of drill jig. This makes a very effective and accurate system of doing work such as this. Fig. 4 shows detail of eccentric spindle. Fig. 5 shows detail of eccentric collar.

Glasgow, Scotland. H. L. CHERRY.

The diameter in quarter inches squared and divided by six equals the approximate weight, in pounds per foot, of a bar of iron.

Discussion of Previous Question

Annealing High Speed Steel in 30 Minutes and New Method of Annealing Carbon Steel

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers.

It was with considerable interest that I noted Mr. Osborne's experience in trying out my method of annealing high-speed steel, thereby producing one of his own. I have been experimenting to see what more I could find that would be new, and as a result have something else that I am going to present to the readers of the AMERICAN MACHINIST for them to try out.

Before turning to my later experiments, I will endeavor to explain the effects of the different heats when annealing high-speed steel in 30 minutes, as referred to by Mr. Osborne.

First, it is not very important whether the temperature goes beyond 1292 degrees Fahrenheit or not, as long as it does not get above 1350 degrees. Twelve hundred and ninety-two degrees is beyond the breaking-down point of this steel and is sufficient heat for annealing and hence it is not necessary to raise the heat any higher. In fact, it is better not to.

Let us suppose that we raise the heat of the steel to 977 degrees Fahrenheit, which is a red visible in the sunlight. This would be sufficient heat to ruin the piece as far as its usefulness is concerned as a cutting tool, but it would not be annealed sufficiently for machining. But if we had heated the piece to 1292 degrees, which is a dull or somber red, allowed it to cool, then again heated it to 1292 degrees, and held it at this point for 30 minutes, it would have been in excellent condition for working, in fact I do not think that it would be possible for it to be improved upon. If we should go through the same process, heating to 1472 degrees, a dull cherry-red, it would be soft and worthless as a tool, but it would work very hard. It is, therefore, my opinion that the heat should not be allowed to go higher than to 1350 or 1400 degrees.

I would prefer to heat the steel as described in my previous article instead of heating for 30 minutes and allowing to cool, then reheating and allowing to cool in the ashes as Mr. Osborne's smith did. Then the first heat places the piece in a proper condition for annealing and allows more time for the process after the steel has been placed in condition by the first heat, than does the method described by Mr. Osborne.

This can be proved by trying a shorter time than 30 minutes on the second heat. This will show that a change is taking place in the steel and it is not completed until the expiration of about 30 minutes. It is only necessary to heat the piece for a period of 49 minutes to prove that the change does not take place in the first heating.

I have annealed bars 9 inches in diameter and 36 inches long, and have watched them as they passed through the different machines. In many cases the toolmakers have been unable to tell me whether the steel was high-speed or ordinary carbon, after it was annealed. As this process is simple, easily observed, and the time for heating is short, it is doubtless the best method of annealing that we have today.

ANNEALING CARBON STEEL

While dealing with the subject of annealing, a few words can be said on the annealing of carbon steel. Years ago I was taught that to anneal carbon steel, it should be packed in charcoal and heated to about 1560 degrees Fahrenheit; especially if this piece of steel was for the engraver. We are told today that the higher the heat when annealing, the softer will be the piece. These timeworn statements I want to contradict, as we do not have a tool steel in use today that should be heated to more than 1490 degrees for annealing, and better results can be obtained if we do not go above 1480 degrees.

I have often advised that the annealing furnace be run at a heat of 1560 degrees Fahrenheit, where I knew it was impossible to get the steel in the proper condition with a lower heat, but there is something wrong with the steel or that amount of heat would not be necessary. When I say that steel will be at its best when annealed at 1480 degrees it is with the understanding that the steel has not been abused in any way.

Notwithstanding the fact that this may be considered a wild statement, I do not believe in pack annealing steel, and stand ready to submit samples with the best pack annealing that can possibly be done. I have a peculiar process of annealing and have never known of its being used.

When having a number of pieces to anneal I keep one furnace running at a heat of 1480 degrees Fahrenheit, and place the steel in here until it is brought up to this heat. I then remove the steel to another furnace that is running at a temperature of 1290 degrees, and as soon as the work has reached this temperature, I shut off the fire and allow the furnace to cool.

Steel annealed in this manner will be soft enough for the most particular workman, and the metal will show a far better physical test in this condition, as well as after it has been hardened. It is just as necessary to have a die, such as is used in a press for embossing, in good condition, as far as elongation and tensile strength are concerned, as it is to have the axle of Barney Oldfield's motor car so it will not break during his great speed drives to regain the world's record.

EXPLANATIONS WANTED

Some of the peculiar things that happen during the day's hardening, I am at a loss to explain, and would be glad to have the readers of the AMERICAN MACHINIST give their experiences.

The first is that of expansion and contraction. We find that high-speed steel will expand twice the amount of that of carbon steel, or ¼ inch to the foot. When cooling a piece of this steel we note that it gets shorter as it continues to cool, until it has reached a temperature of about 300 degrees Fahrenheit. Then expansion starts up and the piece lengthens as it continues to cool, until it has reached the original measurement it had before hardening.

Another peculiar thing is the flexibility of high-speed steel after it is hardened and cooled. Of course, we all know that high-speed steel is the softest steel there is after being hardened, but it is very hard at that; in fact, we would not expect to be able to bend it by striking it a blow with the lead hammer. If, however, the steel has been properly heated, it can be bent much more readily than when annealed at the steel mill.

I have taken a ¾-inch reamer with a 12-inch cutting surface and placed it on centers. Then by striking it a light blow with a one-pound lead hammer, I have bent it as much as ¼ inch. Again, I took a high-speed steel ¼ inch square and 5 inches long and hardened it and then bent it ⅛ inch from the straight when cold.

In the carbon steels a 5/16-inch reamer with a 6-inch cutting surface when heated to the proper hardening heat, plunged in a salt bath and removed with sufficient heat to allow the water to boil nicely on

the reamer, can be bent to most any shape desired by placing it on centers or blocks and striking it a very light blow with the lead hammer. In fact, it will bend more easily than annealed steel and take a permanent set. Thus it will be seen that tools can be straightened in this manner.

Where the piece is too large to be forced out of centers with the lead hammer, I use the screw press. Not long ago, I found the screw press too small for a job that had to be straight within a few thousandths of an inch. The body of the piece was 4x4x8 inches, and I used the hydraulic press for straightening it.

If these same pieces are allowed to cool entirely in the water, they can be moved a few thousandths to a permanent set, but should we undertake to give them a permanent set the following day, the results would be entirely different. Another queer thing is that if the pieces are heated to 300 or 400 degrees Fahrenheit they will not take a permanent set unless they are cooled by a stream flowing on them, as is done in straightening.

I am not sure that it would be of any great value to know just why these phenomena take place, yet it is extremely interesting and I would therefore like to know others' experiences.

Davenport, Iowa. C. U. SCOTT.

Shipping Planer Beds

On page 256, John R. Godfrey referred to the shipping of long planer beds and the strains they are subjected to in transit. In this case, it seems to me that if the heavy beds are loaded in the following manner, no amount of disturbance of the car would have any effect, provided the bed be designed with any decent respect for the duties of iron-planing machine.

First, securely block the bed so it will not shift its position and then put two pieces of 1-inch board one-quarter of the way from the housing end and another piece in the center of the other end. Nail them to the platform of the car and go ahead. If a planer bed would bend under these conditions, it is of poor design.

If the frame was small and supported on legs, blocking would be necessary, but I would do it another way. I would slack off the bolts at the head-end leg about a half inch, raise the bed off the leg and put a ¼-inch shim between the bed and leg, and then when I set the machine in the shop I would insult the builder by leaving it in that condition, preparing two wedges to put under when there was any work that would tend to warp the machine. Putting in these wedges would be doing only what the planer man does when he is blocking up his work, except when he takes off his work he removes the wedges in spite of himself; whereas, in the case of the planer bed, one would have to stand over him with a club to get him to remove them.

In trying this trick of balancing the front end of a machine built by one of the best builders, we found, when left to take its own position, that it showed considerable wind, with the shim, which was a wire, central. By moving this wire 2¾ inches to the right, it was so nearly perfect that the movement of three-quarters of an inch more set it as true as the test level would detect. If the movement of three-quarters of an inch showed a difference, either the level was a good one or the bed pretty frail.

Syracuse, N. Y. JOHN E. SWEET.

Preventing Scale in Hardening

Mr. F. Ches, on page 458 of the AMERICAN MACHINIST, has given what is probably the best method for hardening small fine die work. It may also be applied to the soldering of articles of gold or silver. The boracic acid forms a protective coating that keeps the oxygen of the air from coming in contact with the metal and thus forming an oxide, or scale. Barium chloride performs the same office when hardening steels that require a very high heat.

For ordinary work where the only object is to be able to see the temper colors I find no objection to the use of a cyanide, or sodium chloride heating bath.

I believe H. D. Chapman, on page 460, has things slightly mixed when he states that, "there is no scale formed in tempering," and then in the last paragraph says, "the only guide the temperer has is the color due to oxidation of the surface." If the work, when tempering, is perfectly clean and free from grease, and is exposed to the air, then a thin film of oxide is formed which changes color as the temperature rises. The change is from a faint trace, on through straw, brown, purple, blue and green, to nearly bright, and then to the second blue. In all, about 25 shades can be distinguished by a good eye.

The practice some men have of rubbing a greasy rag over the work as it heats up is all wrong, for the color then is that of the dried oil and not the true temper color of the metal.

Where an open gas flame is used in tempering, turn off the air blast part way, so as to reduce the heat of the flame and then hold the work in it until it reaches the proper color. The flame in this condition is a reducing flame. That is, there is not sufficient oxygen to produce perfect combustion, consequently it is consumed before it has time to come in contact with the steel. The result is that the steel stays bright, even at a high temperature, but the moment it is removed to the air the colors flash over it, and even though it may have been plunged at the right color, the heat has been so high that the temper is too soft and the work spoiled.

Work that has been nicely polished before drawing, and is to have a bright finish, will require repolishing if drawn in the open air. As the color enters every minute scratch it makes it difficult to bring back the original luster by repolishing.

When an oil bath is used for tempering, the work will not change color if it is left in the oil until cold, for the air cannot come in contact with it.

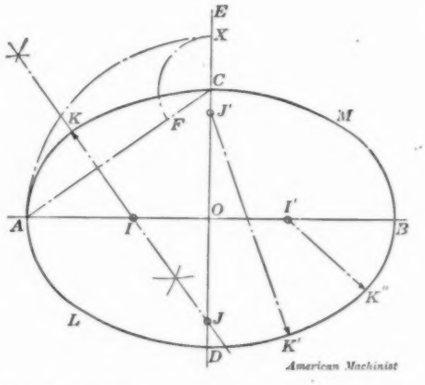
The statement that cyanide or other heating baths cause warping of the work is partly correct and partly wrong. If the work was thoroughly annealed after roughing out, and then carefully preheated before plunging into the hot cyanide there will not be as great a chance for warping as if it were heated in the open flame. If the work has not been annealed after roughing out, or is plunged into the heating bath cold it is almost sure to change form.

Madison, Wis. H. M.

To Describe an Ellipse with Circular Arcs

Here is a method of drawing an ellipse with circular arcs, good for various sizes and a wide range of proportions.

Lay off major and minor axes $A\,B$ and $C\,D$. With center O, describe arc $A\,X$, meeting $C\,D$ extended. With center C,



AN ELLIPSE MADE WITH CIRCULAR ARCS

and radius $C\,X$, describe arc $X\,F$, meeting line $A\,C$ at F. Bisect $A\,F$ with the line $K\,J$, which is perpendicular to $A\,F$. With center I and radius $I\,A$, draw the arc $L\,A\,K$, forming the end of the ellipse. With J as a center, and radius $J\,C$, draw arc $K\,C\,M$, the upper half of the ellipse.

The other parts of the ellipse are drawn in with arcs from points I' and J', the radii $I'\,K''$ and $J'\,K'$ being the same, respectively as $I\,K$ and $J\,K$.

Issued Weekly by the

Hill Publishing Company

JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.

505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

Subscribers can have address changed at will. Give old and new addresses.

Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., m. b. H., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.

Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1909, 1,209,000 *copies. For September,* 1910 *(American weekly, American monthly, English weekly and German weekly), total,* 143,250.

October 6..... 42,000

None sent free regularly, no returns from news companies, no back numbers.

Contents

PAGE

The Knecht Rapid Production Planer.... 615
Making Locomotive Piston Rings..... 619
Electric Arc Welding..... 620
Calculations for Hobbing Gears..... 621
Special Automobile Tool Equipment.... 622
Training Engineers at Franklin Union.. 625
Making Locomotive Rod Cup Grease.... 627
Machining Marine Connecting Rods..... 628
New Forms of Ames Dial Gages..... 629
A Mixture for Dry Hydraulic System... 630
Weighing Materials Automatically..... 631
A Turning Job on the Milling Machine.. 636
Large Belgian Norton-type Grinder..... 637
Valve Reseating Tool..... 638
Pattern and Mold for Odd Shape..... 639
Integrity of Tests of Metals..... 641
Letters from Practical Men:
A Plate Vise....Standard Proportions for Wrenches....Safety Attachment for the Punch Press....Making Small Maple Wood Rolls....Finding the Half of an Odd Number and a Fraction....A Safety Kink for Traveling Cranes....Boring Seats for Spherical Bearings....Heard in the Shop....Charles T. Porter—A Tribute....Making Eccentric Spindles for Automobiles.....643-646
Discussion of Previous Question:
Annealing High Speed Steel in Thirty Minutes and New Method of Annealing Carbon Steel....Shipping Planer Beds....Preventing Scale in Hardening....To Describe an Ellipse with Circular Arcs.....647-648
Improve Shop Working Conditions..... 649
Integrity of Tests of Metals..... 649
New Tools and Shop Appliances..... 651

American Machinist

Editorial

Improve Shop Working Conditions

Great improvement has been made in recent years in shop working conditions. In many establishments, particularly the large manufacturing concerns, the shops are above reproach. Unfortunately, this condition is not as general as it should be and there remains much to be done in the improvement of shop conditions. In a large number of establishments, particularly the jobbing shops, the usual conditions are poor light, little ventilation, lack of cleanliness, no washing arrangements or lockers for the men and poor toilet facilities.

Workmen do not ask for much of the so called "welfare work." In fact, there is little doubt that in cases where the welfare work takes on the aspect of a charity or an advertisement, it is resented by the workmen. Most desirable workmen appreciate clean, well lighted and ventilated shops, which are properly heated during the winter months. They want wash rooms where they can clean up before they go in the streets. They want lockers where they can safely stow their street clothes. They wish for clean and sanitary toilet facilities. There can be little doubt that when these conditions are met the workman is drawn closer to the management or that the lack of these facilities is resented.

Looking at the subject from a business point of view, we are satisfied that it is good business to supply these facilities. There may be some question regarding benefits derived from welfare work which goes beyond the essentials mentioned. There can be no question regarding these. Men cannot work to the best advantage unless these conditions are met. Yet, the number of shops where these requirements are fulfilled is comparatively small. A man cannot do his work rapidly or well with poor light; yet, in many shops the light is atrocious. It is not uncommon to see a workman with a single small electric light at his machine, straining his eyes in his attempt to do accurate work. This is often during bright daylight, as the natural light in the shop is so poor that without the electric light he can do nothing. In very few shops is the light satisfactory. In many shops little or no attention is given to properly heating and ventilating the building or to adequate and sanitary lavatory arrangements.

These conditions are not good for anyone concerned. Men cannot do their best unless these essential requirements are met. Nor will they try to do their best. There can be no question that the increased and better output obtained by supplying these essentials will fully warrant the expenditure necessary. Moreover, the advantages gained by a better feeling on the part of the men toward the management should not be overlooked.

Integrity of Tests of Metals

In other columns we print an article by A. E. Outerbridge, Jr., on this subject, because of its very great importance, not only to the engineering world but also to the public at large. In these days of tall buildings and high-speed transportation, the safety of a great part of our population that must use these engineering structures daily lies in the integrity of the work of the engineer, and he, in turn, must rely upon data from the physical tests of the materials that he uses. Thus the interest of the public at large is vital in this question of the integrity of tests of metals. Several reprehensible practices are pointed out whereby the strength of test specimens can be increased very largely over the strength of the products that they are supposed to faithfully represent. Such practices cannot be too strongly condemned. In fact, it may be a field for legislative action imposing several penalties upon anyone who knowingly changes the character of a test piece so that it does not truly indicate the character of the structural parts from which it was taken, or which it is intended to represent. For such a course may endanger human lives.

We heartily indorse Professor Outerbridge's conclusion in which he points out that a uniform system of investigation should be adopted, thereby doing away with variations in treatment that may cause wide variations in result, and, in the case of cast specimens, that a uniform size should be adopted and a uniform method of molding. On no other basis can results be compared with the assurance that the comparison is just and further that deductions made from such tests may be applied by the engineering world with all of the assurances of safety demanded of engineers.

Is It Good Designing to Greatly Exceed the Guarantee?

We are very apt to speak of a machine which goes way beyond its guarantee as being of good design, while the machine which fails to reach the point ever so little is condemned as a poor design.

But is it any better or even as good design to overreach the mark by a wide margin as to barely miss it?

Of course, the buyer will favor the design which greatly exceeds the guarantee, but is it good designing or good engineering? Does not good designing properly mean coming as close as possible to the mark set instead of greatly overstepping it?

In order to "make good," a designer must allow for a certain percentage of a slip, or loss, in order to be safe, but the ratio of the factor of safety in production has no connection with the factor of safety for strength of parts, and can be very much lower.

Every builder of machinery wants his machine to do all that he claims and a little more. But when a man orders a machine to produce 100 pieces a day, is it good policy to build him a machine that will build 200 pieces?

It is hardly to be supposed that the extra production is to be secured at no extra cost in the design and the building, and if the price was right for a 100-piece machine, it is too low for the one that produces double.

When a motor is rated at 20 horsepower and will stand 30 horsepower on continuous load, it is evidently underrated, and if you really wanted a 20 horsepower you have paid too much and have capital tied up in the motor that might better be elsewhere.

It often happens that the designer who fails by a narrow margin comes much nearer the mark set, than the one who greatly exceeds the limit set and this should be considered before condemning him.

New Publications

The Construction of Graphical Charts. By John B. Peddle. 109 6x9-inch pages, with 58 illustrations. The McGraw-Hill Book Company, New York and London. Price, $1.50.

Our readers are well aware of Professor Peddle's competence in connection with chart making through the articles which we have published from his pen, of which the present volume is, in large part, a reprint. It is, to the best of our knowledge, the first to appear in the English language. The making of charts has received far more attention in Europe, and especially, in France, than here. It has, in France, formed a subject of several treatises, and a name—Nomography—has been coined for the art.

In addition to extremely clear explanations of the method of going about the construction of charts of various types, the book contains a chapter on the reverse process of obtaining empirical equations from diagrams resulting from the charting of experimental observations. There is also a chapter on solid models and three dimensional charts.

The subject is beginning to attract attention in our schools of engineering, and the volume is well adapted for use as a text book in such schools. It might have been expanded to much greater length, but in the present development of the art in this country, this would probably have been unwise. As it stands, the essentials of the subject are covered, and to have expanded the discussion to undue length might have resulted in a defeat of the author's purpose.

The book fills a distinct gap in American engineering literature, and we do not doubt that it will be well received.

Factory Organization and Administration. By Hugo Diemer. Three hundred and seventeen 6x9-inch pages, 150 illustrations in the text. McGraw-Hill Book Company, New York and London. Price, $3 net.

Professor Diemer has given us a valuable work on factory organization and administration, beginning as he does with the economic theory of factory location, and then continuing through the interrelation and functioning of all of the departments. Basic principles are clearly stated, and in that regard the book is general in character, yet its immediate application, and many, if not the majority, of its illustrations, both of existing plants and of factory systems, are from machine shops, and such chapters as the Drafting Department, the Pattern Department, Stores and Stock Department, Production Department, Foundry System, the Machine Shop and Tool Department, Inspection Methods in Modern Machine Shops, are devoted particularly to a discussion of machine-shop problems. Considerable space is devoted to a description of methods, systems and devices, and in these cases much of the material deals with the newest and uptodate systems that are in use. As a mild criticism it might be said that perhaps too much space has been devoted to showing specimen forms, blanks and cards, yet many of these are necessary by way of illustration, and the point of such a criticism is turned by this paragraph from page 5.

"The adopting of another company's printed forms is no more of a substitute for production engineering than would the adoption of another company's tooling jig be a substitute for a tool-designing department."

The last chapter is of particular value to the student of works management, as is seen from its title, "A Bibliography of Works Management." The book is written in a clear, interesting style. It deserves to be well received by all who are interested in the subject of which it treats, whether they be officers of manufacturing corporations, works managers, superintendents, accountants, heads of shop departments, or engineering students.

Heat Engines. By John R. Allen and Joseph A. Bursley. Two hundred and eighty-eight 6x9-inch pages with 157 illustrations. The McGraw-Hill Book Company, New York and London. Price, $3.

The authors of this book, who are professors in the engineering department of the University of Michigan, have in it gathered together material which has been used in their classes for a number of years. Except for the chapter on Elementary Thermodynamics, it is almost entirely descriptive in character, and it may be described as an elementary descriptive textbook for beginners in the study of the steam and gas engine and steam turbine, including boilers, fuels, condensers and the testing of steam engines.

Personals*

C. C. Wilcox, until recently instructor in the Michigan Agricultural College, has become assistant consulting electrical engineer of the Hodenpyl-Walbridge Company, Detroit, Mich.

Thomas F. Skelly, for a number of years connected with the Midvale Steel Company, has joined the selling organization of the Halcomb Steel Company, with headquarters at the Chicago office.

A. F. Merry, general foreman of the transformer department machine shop of the General Electric Company, Pittsfield, Mass., leaves that position to become mechanical superintendent of the new plant of that company at Erie, Penn.

J. M. McDowell, formerly president and manager of the Russell Drill Chuck Company, is now associated with the Morrow Manufacturing Company, Elmira, N. Y., in the capacity of general sales manager of the drill-chuck department.

George A. Buvinger, until recently hydraulic engineer with the D'Olier Engineering Company, Philadelphia, Penn., has become connected with the Allis-Chalmers Company, West Allis, Wis., as designing engineer in the centrifugal-pump department.

E. G. Richards has been appointed general manager of the Hilliard Clutch and Machinery Company, Elmira, N. Y. Mr. Richards was formerly with the Dodge Manufacturing Company, acting for a number of years in the capacity of superintendent of its iron department.

*Items for this column are solicited.

New Tools and Shop Appliances

Cincinnati Universal Grinding Machine

The machine illustrated by the accompanying engravings is of massive proportions and has been designed essentially as a manufacturing tool for grinding cylindrical work, either straight or taper, and chuck and faceplate work; it is in addition well adapted to the grinding of gages, dies, cutters and other tools, together with the miscellaneous parts requiring to be machined in shops and manufacturing plants.

This grinder is fitted with speed and feed boxes that enable the operator to obtain at once, from a central position in front, any speed or feed within the range provided, reducing the entire overhead works to a drum and single shaft carrying four pulleys. The headstock has one pulley only for both live and dead center grinding. A variable table dwell is provided for at points of reversal, and there is an automatic cross feed with positive stop for the production of duplicate diameters. The separation of work speeds and table feeds makes possible the use at all times of a correct table feed for any work speed, a single lever instantly starting or stopping the rotation of the work and travel of table in conjunction with each other.

The machine is shown in Figs. 1 and 2. The base, which has a three-point bearing for maintaining perfect alinement, is of box form, stiffly ribbed and cast integral with the water tank and wheel-slide pedestal to form a rigid, unyielding unit.

ANY and all new or improved machines, tools, or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here—the machine shop news.

A more full and detailed description will be given—when it is real news—if it can appear here first—before it is sent to other papers. All descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German.

The sliding table which touches on one V and one flat way is controlled by adjustable dogs operating against the reversing lever, which actuates a clutch of the "load-and-fire" type contained in the automatic feed plate, a complete unit bolted to the front of the machine. The travel being independent of work or wheel speeds permits of traversing the work at each revolution the full width of the wheel face for the removing of stock rapidly. Power is transmitted through the belt shown at the end of the machine to worm gearing by which the table is actuated, insuring smoothness and uniformity of motion. The reversing dogs give the fine adjustment required when grinding to shoulders, permit traversing the table beyond the points of reversal without disturbing the initial setting, and readjust themselves after the table has been returned to its original position, thus preventing it from feeding too far and injuring the work.

In Fig. 3 is a section through the table drive, showing the driving shaft at *A*, which operates the reversing gears while the hardened-steel worm and bronze wormwheel are seen at *B*, with an adjustable clutch at *C*, by which the table dwell at the end of the travel is varied. The lever in front may be set to drop the clutch teeth more or less into engagement, and owing to their taper form, the further the upper member of the clutch is withdrawn from the bottom of the corresponding teeth on the lower member, the longer will be the tarry at the end of the stroke. With the clutch lifted entirely out of engagement by its lever, the table drive is disengaged and the table may then be moved by its handwheel.

The swivel table on the sliding table pivots on a hardened and ground central stud and can be set at an angle for

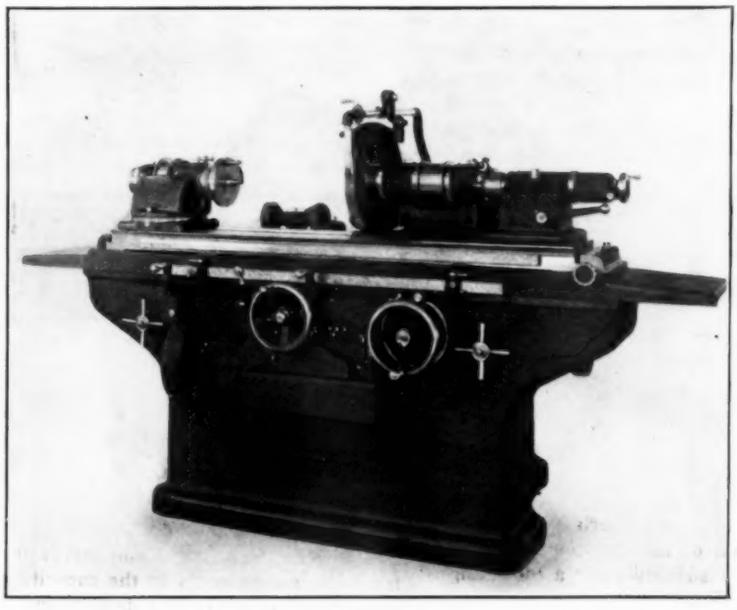


FIG. 1. UNIVERSAL GRINDING MACHINE WITH WATER GUARDS REMOVED

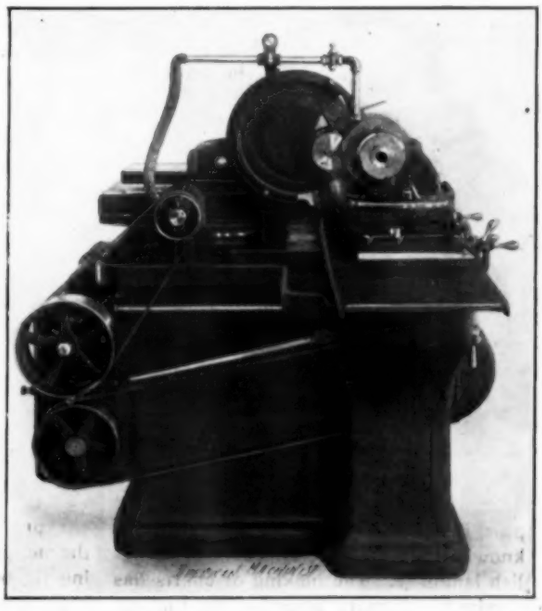


FIG. 2. END VIEW OF GRINDER SHOWING GEAR GUARDS REMOVED FROM HEADSTOCK

grinding tapers. It is graduated to read in degrees and taper in inches per foot, adjustment being made by rack and worm at the end, and direct-reading scales indicating the position. The table may be moved beyond the marks given on the scale without special disconnection and the table swung through an arc limited only by the wheel slide.

The wheel spindle carries a wheel 14x1½ inches, is hardened and ground and runs in phosphor-bronze boxes provided with means of compensation for wear. The wheel stand is universal in

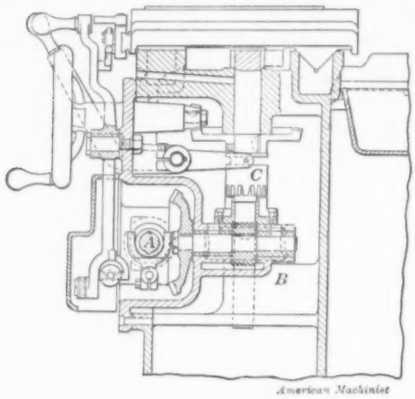


FIG. 3. TABLE-OPERATING MECHANISM

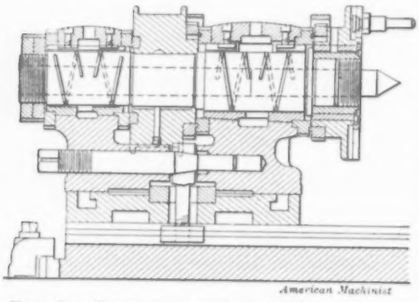


FIG. 4. SECTION THROUGH HEADSTOCK

all its parts. The wheel-stand slide rests upon long, broad ways and is so designed as to prevent jumping or sticking during delicate adjustment, or lifting under heavy cuts. It has a graduated swivel base. The transverse movement is controlled and adjusted by a handwheel on the front of the machine graduated to read in thousandths on the work diameter, a fine hand feed graduated to quarter thousandths being available upon locking the automatic cross feed and turning the thumb piece to suit the adjustment required. The automatic cross feed, which ranges from 0.00025 to 0.005 inch at each reversal of the table, is automatically thrown out when the work has been reduced to the required size; regulation being by the simple turning of a thumb device at the front.

The headstock, Fig. 4, has a graduated swivel base and may be locked securely to the swivel work table. The hollow spindle, which has a No. 10, Jarno taper hole, is hardened, ground and lapped and runs in bronze boxes, having provision for compensating for wear. As shown in Fig. 2, the work is revolved through gearing (the gear guard being shown removed) while the single pulley requiring but one belt, is available for either live or dead center grinding. A simple device locks the pulley to the spindle for grinding on live centers. A supporting way is directly under the work at all times, and alinement is maintained through an inverted "V" depressed so that its upper edge is flush with the table surface in order not to interfere with the clamping of attachments. The foot stop is alined and held in a similar manner. It has a convenient device for the diamond tool holder for truing the wheel without removing the work, and is well protected from grit and water. The spindle may be operated by handwheel or quick acting spring controlled by a lever.

The universal back rests for supporting long, slender shafts take up the reduction in grinding, and though rigid, are capable of delicate adjustment. The pump is of the well known centrifugal type. Suitable water guards are provided, which are carried by a rail at the front of the swivel table. With the equipment, which includes such parts as draw-in collet, combination chuck, faceplate, rests, dogs, etc., there is also included an internal grinding fixture.

The 12x36-inch machine illustrated, is known as the No. 2. It has ten work speeds and twelve table feeds through the gear boxes at the rear, controlled by the star wheels at the front and the lever near the left-hand end of the base. The wheel spindle is 2¾ inches diameter, and is driven by a 3-inch belt. The machine weighs 5300 pounds and is built by the Cincinnati Grinder Company, Cincinnati, Ohio.

Two New Lang Tool Holders

Fig. 1 shows a tool holder for use in the vertical boring mill. The cutter is triangular in section, extra large and is intended primarily for taking heavy roughing cuts. Owing to the shape of the cutter the top and side angles are correct and it is only necessary to grind on the end to resharpen.

Fig. 2 shows a general lathe and shaper tool for the lighter classes of work, the largest size of this style using a triangular cutter ½ inch across the flats. The cutter

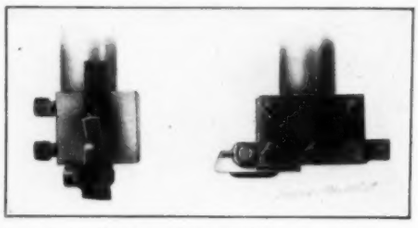


FIG. 1. A VERTICAL BORING-MILL TOOL HOLDER

is seated in a V in the cylindrical bushing. The holder, set screw and bushing

FIG. 2. A LATHE AND SHAPER TOOL HOLDER

are made of tool steel tempered. These holders are made by G. R. Lang Company, Meadville, Penn.

Disk Wheel Cementing Press

The improved disk-wheel cementing press, illustrated herewith, has been brought out by Charles H. Besly & Co., Chicago, Ill.

The top plate may be swung out of

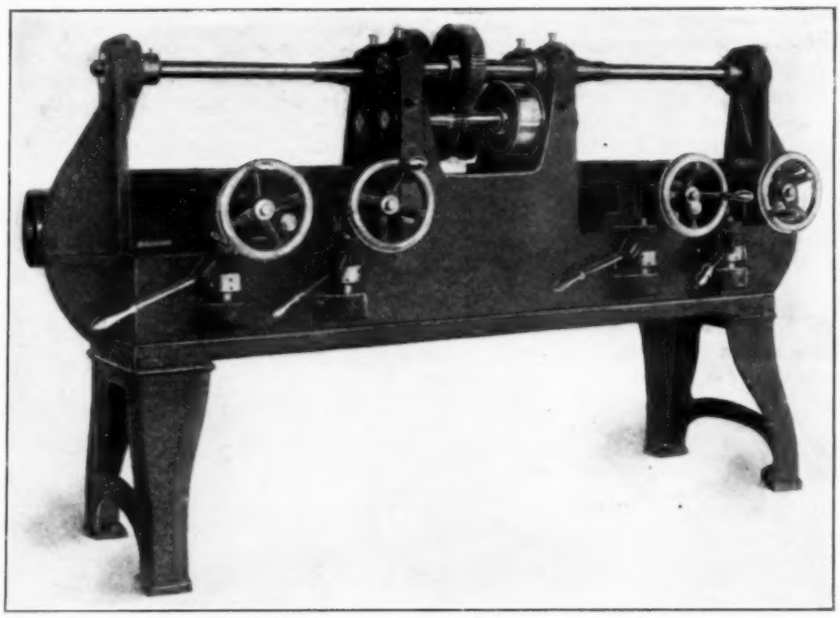
DISK-WHEEL CEMENTING PRESS

the way while the disk wheel is being glued, and swung back into position when pressure is to be applied. The press accommodates wheels 26 inches in diameter and smaller, and a desirable feature is a mechanical arrangement for lowering and raising the wheels in view of the fact that a 26-inch Besly wheel weighs 125 pounds.

This is accomplished by a central-shouldered shaft which is actuated by a cam movement connected with the lever at the left. In raising the cam is thrown slightly over the center and against a bumper pin. This holds the disk suspended of its own weight. In lowering, the disk is raised slightly by means of the lever shown, to permit the cam to come over the center, and then lowered until the disk wheel rests on the pedestal casting. When pressure is to be applied, the yoke swings into engagement with stud set in pedestal at the left. No lock is necessary, as the pressure holds the yoke in position.

The Garvin Four-slide Milling Machine

The accompanying illustration shows a new machine, which has just been brought out by the Garvin Manufacturing Company, New York. It is a special type of milling machine adapted for manufacturing operations, such as the cutting of oil grooves in automobile axles, keyseating, fluting, notching, squaring ends, flatting, etc.



FOUR-SLIDE MILLING MACHINE

The machine is virtually four separate machines, reduced to their simplest elements, combined in a small compass, and to be operated by one man. Each slide is independent, consequently three slides may always be working while the fourth is being loaded, so that the machine is constantly in operation. There are two cutter spindles, each equipped with powerful back gears. One spindle serves the two slides on the right end of the machine, and the other the two on the left. The spindles are also independent, so that one side of the machine can be kept at work, while the cutters on the other side are being changed or ground.

The slides feed by power or by hand, through a feeding screw, which allows a travel of 12 inches, and is provided with an automatic trip. Independent vertical screw adjustments are possible to the slides, for setting work of different sizes, or to allow for wear and variation in the cutters. In addition to the vertical screw adjustment, each slide has a quick lifting movement through spiral roller collars, operated by levers which may be seen on the front of the machine. These are used for sinking to the depth of the cut, or dropping out, on the return, etc. There are 12 changes of feed, driven from the countershaft.

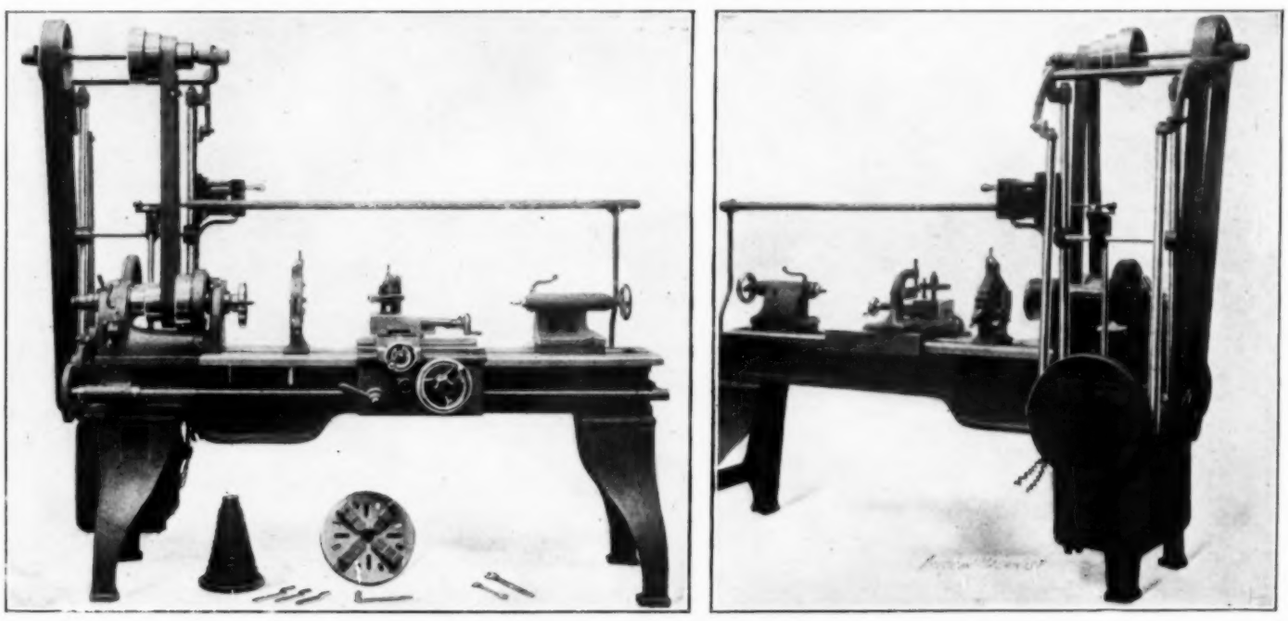
A modification of the machine has adjustable spindles, of the Lincoln miller design, giving a larger vertical range.

An Electrically Driven Engine Lathe

The halftones show front and rear views of an electrically driven lathe built by Engels & Waegner, Wald-Strasse 24, Berlin, N. W., Germany.

The motor, which may be of any desired type and for either direct or alternating current, is mounted inside a box cast integral with the legs at the headstock end. In this position it is protected from chips and dirt. The motor runs at constant speed and in one direction only.

Attached to the leg containing the motor is a frame supporting the countershaft, which runs in ring oiling bearings. The countershaft is belt driven from a jack shaft at the rear of the headstock. Mounted loosely on this jack shaft are two bevel gears, either of which can, by means of a clutch, be made to drive the jack shaft. These gears engage on either side of a third bevel gear, which is mounted on a shaft driven through spur gearing by the motor. The shifter rod connects with the yoke controlling the frictions on the jack shaft bevel gears, one of which when clutched drives the lathe forward, while the other reverses it.



FTONT AND REAR VIEWS OF A GERMAN ELECTRICALLY DRIVEN LATHE

With both frictions out of engagement the lathe is at rest.

With this arrangement of motor drive the lathe does not require any extra floor space and in case of emergency is easily moved as a unit.

A Fuel Oil Brazing Outfit

The halftone shows a fuel oil brazing outfit which is being put on the market by the Gilbert & Barker Manufacturing Company, Springfield, Mass.

Fuel oil and air are used in this burner, combustion being completed in the burner itself so that a flame like that of gas, entirely free of smoke, is directed upon the work. The outfit is obtainable in portable form also.

FUEL OIL BRAZING TABLE

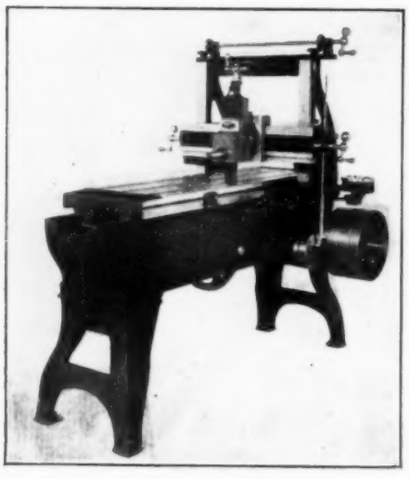
A Metal Planer

The halftone shows a planer which has just been put on the market by the Schneider & Goosmann Machine Company, Cincinnati, Ohio.

This planer will take work 16x16 inches by 3 feet long. While the table measures 3 feet between pockets, the rack is 4 feet long so that when necessary, a cut can be taken beyond the table ends and under these conditions the table will not lift from the Vs, gibs being provided on the inside of the table.

The belt is 1¼ inches wide and the ratio of belt to cutting speed is 32 to 1. The tool post will take a tool ⅝x1¼ inches.

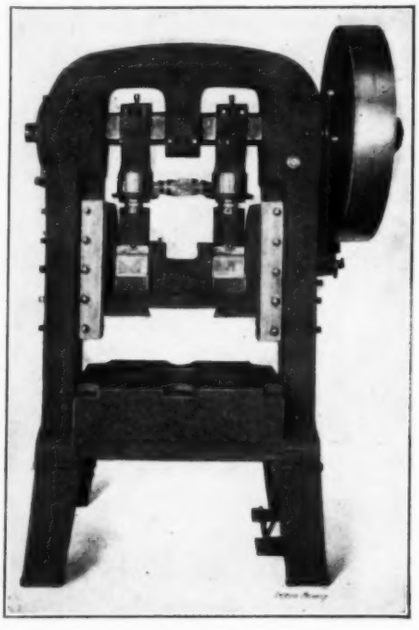
The down feed is by hand, but cross feed in either direction is by power. The tool slide has a micrometer dial on the feed screw.



A METAL PLANER

A Double Crank Press

The halftone shows one of a new line of double-crank presses, built by the Standard Machinery Company, Providence, R. I., and known as their double-crank J press. The new features are the method of adjusting both connections with one wrench and the extra heavy and rigid lines of design and the construction of the ram, boxes and shaft bearings. The machine is fitted with the instantaneous Horton roller friction clutch, allowing less than 1/32 inch travel of the periphery of the wheel after it is engaged. The driving wheel on the plain press is 60 inches diameter and has a ton of metal in the rim. The driving wheel of the back-geared press is 42 inches diameter and weighs 1400 pounds. The slide of the machine is made extra wide to accommodate blanking dies of a large area. The thrust blocks in the ram are of bronze, and the connections are of iron and steel. The two connections are adjusted simultaneously by means of the bevel gearing shown.



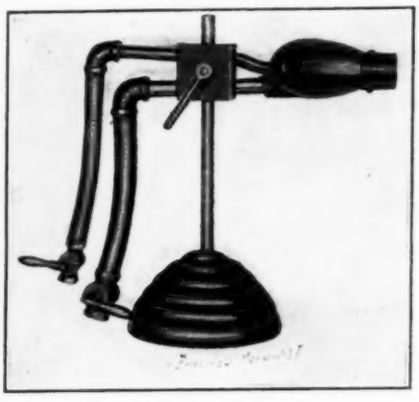
A DOUBLE-CRANK PRESS

This method allows the adjustment of the ram with comparative ease. The ram without any attachments, dies or boxes weighs 1000 pounds, and with boxes, lower connection, attachments, etc., it will weigh between 1800 and 2200 pounds. Although this weight is considerable to be lifted with the above ratios, a man can do it with comparative ease with a 14-inch wrench. The No. 6 J press shown is 44 inches between uprights, 112 inches high over all and 28 inches front to back. It occupies floor space 60x75 inches. The plain press weighs 11,500 pounds and the geared press weighs 13,500 pounds.

A Bench Torch

The halftone shows a bench torch made by C. U. Scott, Davenport, Iowa. This torch can be operated either with city or gasolene gas and air at 1½ pounds pressure.

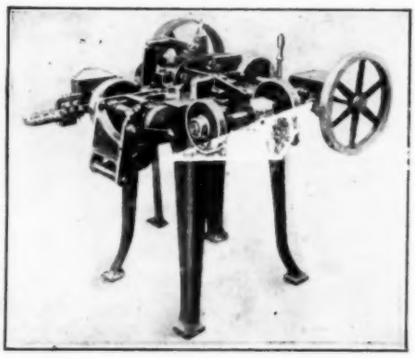
Any size of flame from a needle point to one 3 inches in diameter can readily be obtained. The stand is 10 inches high and any length of flexible hose can be attached.



A BENCH TORCH

A Four Slide Wire Forming Machine

The halftone shows the new model four-slide wire-forming machine, which has been put on the market by the Man-



A FOUR-SLIDE WIRE-FORMING MACHINE

ville Brothers Company, Waterbury, Conn.

In this machine all the objectionable features of the older machines have been eliminated, besides which special attention has been given to convenience in handling the adjustments, all of which are now so arranged as to be within easy reach of the operator when standing in front of the machine.

A Large Greenerd Arbor Press

The halftone shows the smallest of a new design of arbor presses which have just been put on the market by Edwin E. Bartlett, Boston, Mass.

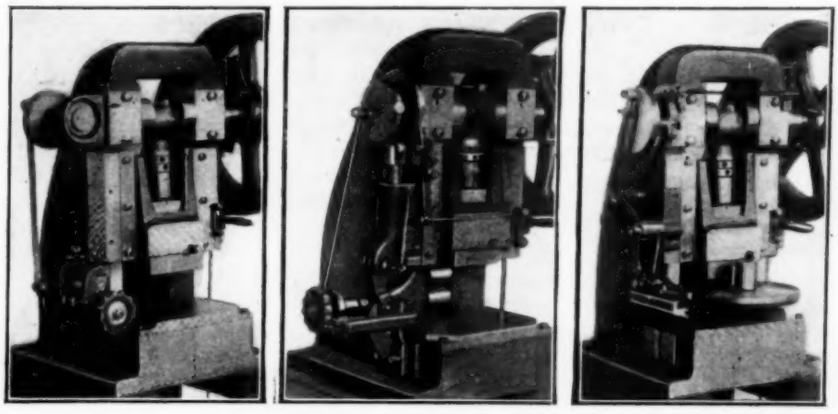
The press shown is known as the No. 13 press and will take work up to 30 inches diameter. The two larger sizes will take work up to 36 inches diameter. The presses are mounted, as shown, on wheels, so that they may be easily moved about the shop. The bottom of the mandrel pocket is lined with soft metal.

Attachments for Baird Presses

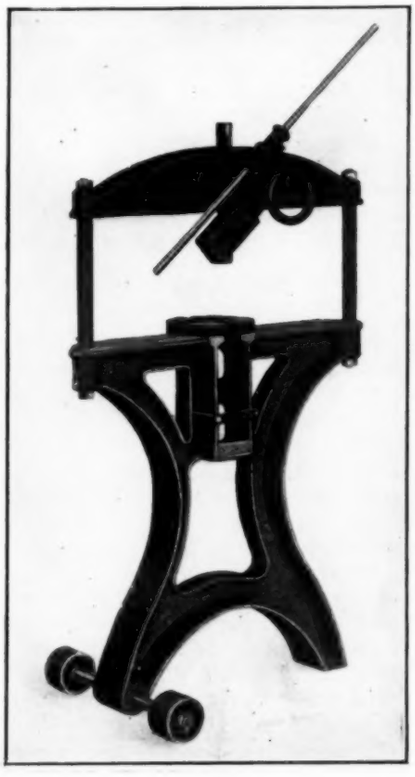
The halftone shows side and back roll feeds and dial feed as applied to the Baird presses, built by the Baird Machine Company, Oakville, Conn.

As described on page 416 these presses are all provided with planed seats for the attachments, which can be applied at any time to the press without sending it to the factory to have them fitted.

The transfer attachment is provided with a positive stop which stops the press should the blank for any reason not be transferred to its proper position.



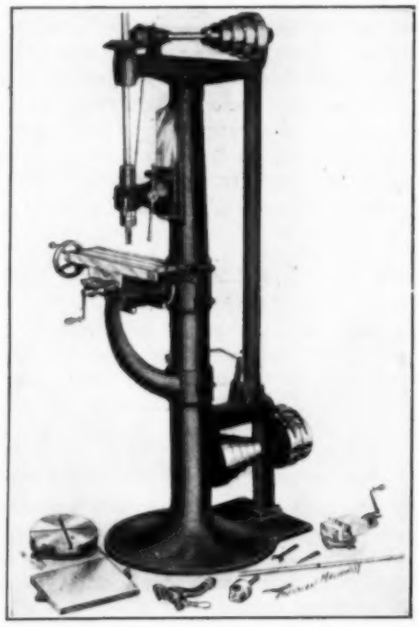
ROLL AND DIAL FEEDS FOR PRESSES



A LARGE ARBOR PRESS

The Knight Drilling and Milling Machine

The W. B. Knight Machinery Company, 2019-2025 Lucas Ave., St. Louis, Mo., is placing on the market a new model of their No. 1 drilling and milling machine. This machine has nearly three times the cutting power of the former machine and is much more rigid throughout. It is now equipped with the arm or knee for supporting the table, as shown in the halftone.

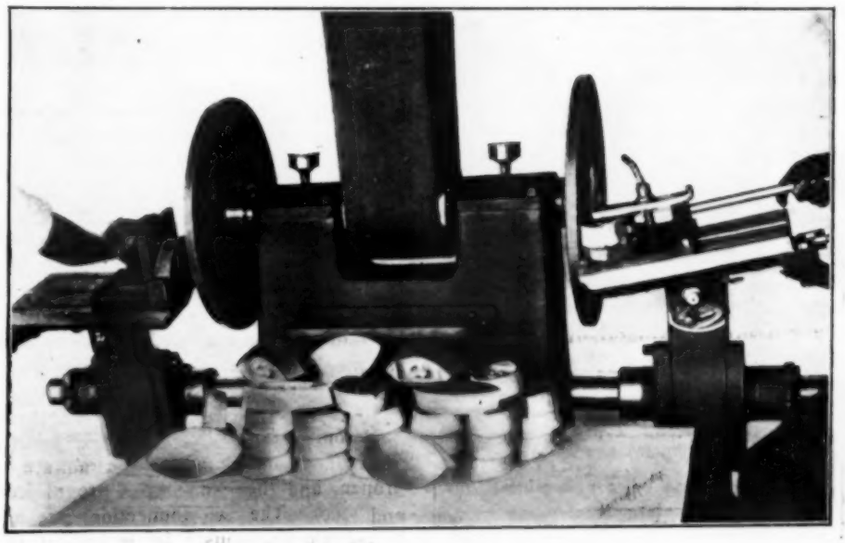


KNIGHT DRILLING AND MILLING MACHINE

Test on Grinding Sad Irons

An interesting test on disk grinding sad irons has just been made in the experimental department of the Gardner Machine Company, Beloit, Wis.

Sad irons as shown in cut are cast iron 1½ inches high and 6¼ inches long, rounded to point on each end, and 3⅝



DISK GRINDING SAD IRONS

inches wide at the center. The bottoms present a solid surface area of approximately 16 square inches, and of about 10 square inches on each side.

A No. 4 Gardner Grinder equipped with two universal lever feed tables and 20-inch diameter disk wheels was used, as such large unbroken areas of cast iron require a heavy, powerful machine with force feed. It would be impracticable to attempt this work on a light disk grinder or without employing a lever feed table.

In grinding the bottoms the irons were dropped into a simple recessed angle plate mounted on the left-hand lever table. No clamping of the work was required. The piece was allowed to "float," thereby conforming to the surface of the disk wheel. The operation of grinding the bottoms was done in 45 seconds each.

A simple fixture with quick-acting clamp bar and swinging handle was used in grinding the bevel sides. This fixture pivots on a 4-inch radius to produce the proper curve. The lever feed table was tilted to the required angle to give the correct bevel.

It took 35 seconds to grind each of these two curved faces, making the total time of finishing the three faces complete 1 minute and 55 seconds.

It should be borne in mind that these sad irons were ground right from the rough castings, no machine work having been previously done. With a little more care in producing a better casting—that is the surfaces more nearly straight and not full of bumps and burs—the time could be decreased considerably. The record time thus far made for grinding sad irons on the Gardner machine is 1½ minutes each to complete the iron.

Why Many Manufacturing Plants Fail

By William E. Bailey

Some of the more common causes of failure in manufacturing enterprises.

The personnel too often made subservient to the capital; the tendency to make large initial expenditures for equipment often responsible for financial difficulty when business is brought to substantial basis.

That so many manufacturing enterprises fail, notwithstanding the fact that they are started under the most favorable auspices, with generous capital, and an article or invention of perhaps exceptional merit, protected by broad patent claims, together with an almost unlimited demand, has been difficult to understand by the investing public and often little understood by the managers themselves.

During an experience of over twenty-five years in manufacturing lines, I have been an interested witness of the beginning and progress of many enterprises that had excellent promise and with all of the above features to warrant the venture, only to finally fail and lead to a total loss of the money invested, much of which represented the savings of frugal but confiding people, and also bring down upon the inventor or promoter a torrent of criticism for the result, while he might have been, and often was, entirely blameless.

Many cases of failure that have come under my observation have been due to an improper organization of the company at the beginning; in fact, I am convinced that most of the unsuccessful enterprises that begin with good promise owe their misfortunes to this cause.

For illustration, we will assume that a machine has been perfected in which there is exceptional merit and a stock company has been organized for the purpose of manufacturing and placing it upon the market. If the officers are chosen with respect to their special fitness, by previous experience or training to fulfil their respective positions intelligently, and if a majority of the directors or managers are familiar with the general methods of machine manufacture, or have a practical knowledge of the particular line of manufacturing to which the machine applies, success is assured from the start.

The Leading Investor Manager

There is a too general practice, however, when organizing new companies, to place those investing the most capital, or those possessing some real or fancied influence in the community, in many, if not all, of the positions of responsibility, and while they may have been successful in their respective lines of business, they are often entirely ignorant of the requirements of the new business, the management of which they assume to control.

It may be said in argument, that to properly direct a business, it is not necessary for the managers to possess a knowledge of details, as that portion of the work can, and should, be left to experts employed for the purpose, and, further, that the same general principles control in all business enterprises, but I think a retrospect of the most successful concerns will show that their managers are men who are individually familiar with important details, or have a general practical knowledge of the particular branch of industry.

Of course, it must be acknowledged that it would be impossible to organize all new companies in a manner as near ideal, as is attained after the business has survived the first few years, and therefore, there will always be inexperience to handicap a new enterprise, and much to be learned by those most interested and most depended upon.

It is true that a practical knowledge of the details of manufacturing is not necessary to a board of managers, whose majority have had a wide and general business training, provided they are willing to entrust the direct control of such details to competent and trustworthy men, and hold them responsible for results, and it is the failure to do this that causes much misfortune.

The Results of Interference

Contrary to this policy, there seems to be a tendency shown in many cases by individual members of the board of managers, who have had absolutely no previous knowledge of manufacturing or mechanics of any kind, to interfere in many ways, especially after having obtained by observation and close contact with the practical men, just enough knowledge of a superficial nature, to convince themselves that they are competent to criticize, a factor largely responsible for many failures.

The usual result of such interference is either frequent changes in superintendents, or so much embarrassment, that the practical man cannot use his best judgment, or give the best results of his long experience, but finds himself conceding a little here and a little there in deference to someone higher up, until some evil consequences occur, and then he finds that he alone is held accountable for what would have been avoided had there been no interference.

It has been wisely said, that the successful business manager is one who can surround himself with trustworthy men, especially qualified for the different departments of his business, and then trust them.

The Employment of Relatives

Another too common cause of failure, is the practice of giving employment to relatives and friends of the officers or managers, who have no real ability or qualifications to warrant such employment, and it has been shown many times that such practice often demoralizes the entire force and precludes the existence of proper discipline in factory management.

Instances in which the chief of a department, who has no practical knowledge of the work under his charge, but draws the salary of an expert, and depends entirely upon the skill and faithfulness of those under him for results, but always stands in fear that the merit of someone upon whom he most depends may become known to his disadvantage, are, I am sure, too common. The detri-

mental effect of such cases to the business is not confined to the amount of the person's salary, but includes the loss due to lack of interest of those under his charge who have little incentive to fit themselves for promotion, and probably receive little or no credit for extraordinary skill or interest shown, thus preventing the accomplishment of the best results and causing an actual financial loss hard to estimate.

The Conservation of the Capital

Another too common mistake is the lavish expenditure of the ready capital at the beginning, when an economical and conservative policy should especially prevail, as it is often found that a new article or machine, notwithstanding its similarity to others has some features that require special methods and facilities to obtain the required efficiency and these requirements are usually disclosed only after the product has entered the field of actual commercial use.

A conservative policy at the beginning will often prevent large expenditures for machinery and tools that become obsolete in a short time, and permit the purchase at the proper time of the most efficient equipment at the minimum cost.

An injudicious use of the capital available at the beginning and during the first period of the development of the business often results in a lack of funds just as the point is reached where profit is to be realized and the inability to interest more capital at this critical point is often the cause of failure of exceptionally good business propositions.

People who will show surprising credulity and enthusiasm, in investing in an enterprise in prospect only, will exhibit a greater amount of doubt and caution when asked to invest in something that has been in operation a period, seemingly sufficient to bring it to a paying basis, and it is often difficult indeed to make a satisfactory explanation for the requirement of more capital, if there is merit in the enterprise, from which it will be seen that a great deal depends upon accomplishing as much as possible with the first capital raised.

Of course, many other reasons for the failure of good projects will occur to the experienced reader, but I believe one or more of those I have noted could, with justice, be brought to the defense of many an honest inventor or promoter who, through lack of opportunity to be heard, often bears the full responsibility for unsuccessful commercial results.

Increasing Shop Capacities

Metal Working

News items for the sales department—where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip—facts.

NEW ENGLAND

The foundry of the Miller Iron Company, Providence, R. I., was badly damaged by fire.

Clark Bros. Bolt Company, Millidale, Conn., has awarded contract for the erection of a new factory building.

The Wyman & Gordon Company, Worcester, Mass., manufacturing drop rofgings, is adding to its plant. New equipment will be installed.

The Henry & Wright Manufacturing Company, Hartford, Conn., building drilling machines, is said to be considering the removal of its plant.

The Pneumatic Scale Corporation, Ltd., Norfolk Downs, Mass., manufacturing automatic weighing and sealing machinery, has about completed the addition to its plant.

The new addition to the plant of the Underwood Typewriter Company, Hartford, Conn., which will add about 45 per cent. more floor space, is about completed and equipment is being purchased.

MIDDLE STATES

The La Crosse (Wis.) Plow Company will erect a new foundry.

Edward Mahyer & Son are building an iron foundry in Newark, N. J.

The Moline (Ill.) Pump Company will move its plant to Ottumwa, Iowa.

The Michigan Crank Shaft Company will erect a new factory at Detroit, Mich.

The Menig Sheet Metal Works, Buffalo, N. Y., will erect a two-story addition.

Frank Sheremith, of Oconomowoc, Wis., will erect a garage at Hartland, Wis.

The Nagle Iron Works, Wilkes-Barre, Penn., is seeking suitable location for a plant.

The Buffalo (N. Y.) Tool Supply Company is looking for suitable site for a factory.

The Railway Roller Bearing Company, Syracuse, N. Y., will build a large new plant.

The McCaffrey File Company, Philadelphia, Penn., will erect a two-story addition to its plant.

The Linde Air Products Company, Buffalo, N. Y., has taken out a permit for a $10,000 addition.

The Wayne Auto-Axle Company, Fort Wayne, Ind., has completed plans for a new factory.

The Imperial Pneumatic Tool Company, Athens, Ga., is preparing plans for enlargement of its plant.

The River Furnace Company, Cleveland, Ohio, will build a $25,000 furnace at 2600 West Third street.

The Burke Electric Company, Erie, Penn., manufacturing electric generators and motors, is erecting a new shop.

The Maryland & Pennsylvania Railroad has commenced work on new roundhouse and shops at Baltimore, Md.

Weaver & Little, who conduct a foundry at Front and Lehman streets, Lebanon, Penn., will add a machine shop.

The Marion (Ohio) Shovel and Dredge Company will soon award contract for the construction of a new plant.

The Niles Tool Works, Hamilton, Ohio, is to erect a new foundry building to have a floor space of 80,000 square feet.

Plans have been completed for rebuilding the car shop of the South Shore Railroad at Marquette, Mich., recently burned.

T. J. McCormick, Springfield, Ohio, is interested in a proposition to establish a new automobile factory in the Far West.

The Orange County Traction Company, Newburgh, N. Y., is considering the erection of a machine shop at West Newburgh.

The Reed Manufacturing Company, Erie, Penn., manufacturing vises, wrenches, etc., is building an additional three-story shop.

The new shop now being erected by W. E. Leard, New Brighton, Penn., manufacturng connecting rods, etc., is almost completed.

The Reliance Electrical and Engineering Company, Cleveland, Ohio, will build a $30,000 factory on East Collamer avenue.

The American Valve and Meter Company, Cincinnati, Ohio, has commenced the erection of a new factory on Spring Grove avenue.

Two modern merchant mills are to be installed in the Brown-Bonnell plant of the Republic Iron and Steel Company, Youngstown, Ohio.

The Woods Motor Vehicle Company, 535 West Fifty-sixth street, New York, is said to be considering the location of its factory in the Central West.

The American Steel and Wire Company, of Cleveland, Ohio, has issued a list of tools required for its machine shop at its new plant in Corey, Ala.

The plant of the Carley Heater Company, at Olean, N. Y., was damaged by fire to the extent of $10,000. The company manufactures tannery machinery.

Equipment is now being purchased for the new plant of the Simonds Manufacturing Company, at Lockport, N. Y. The company manufactures saws, files, etc.

The Di-el-ite Manufacturing Company, Germantown, Philadelphia, Penn., is in the market for machinery for tapping small malleable pipe fittings in large quantities.

Slaysman & Co. has purchased property at 801 East Pratt street, Baltimore, Md., and will establish a plant for the manufacture of can machinery, power presses, etc.

Factory No. 2, of the Salisbury Wheel Company, at Jamestown, N. Y., was destroyed by fire, causing a loss of $75,000. This was devoted to making axles for automobiles.

Frederick Sedgewick, 709-97 Clark street, Chicago, Ill., representing the American Cipher Machine Company, is looking for a suitable location on which to erect a plant.

The Gus Peck Foundry and Manufacturing Company, Le Mars, Iowa, manufacturing well-

drilling machinery, is planning the erection of a new foundry to take care of increased business.

The S. Morgan Smith Company, York, Penn., is making additions to its plant which will double the machine and erecting shop capacity. Also capacity of power plant will be doubled.

The Bishop Calculating Recorder Company, New York, has been incorporated to manufacture calculating machines, etc. Capital, $10,000. Incorporators, C. A. Bishop, W. M. Bristol, J. H. Griffin.

The Carroll Vehicle Company, Portsmouth, Ohio, has been incorporated to manufacture automobiles, carriages, wagons, etc. Capital, $10,000. Incorporators, E. G. Millar, Wm. J. Gims, J. E. Carroll, etc.

The Bennington Manufacturing Company, Dallas City, Ill., has been incorporated with $15,000 to manufacture sheet-metal goods. Incorporators, A. L. Bennington, J. T. Bennington, J. S. Bennington, Jr.

The Electric Lighting Company, Indianapolis, Ind., has been incorporated to manufacture electric-lighting appliances. Capital, $100,000. Incorporators, C. C. Wedding, S. C. Renick, W. H. Harbison.

The Cleveland Novelty Manufacturing Company, Cleveland, Ohio, has been incorporated to manufacture metal and wooden novelties. Capital, $10,000. Incorporators, E. O. Floyd, Victor Moore, H. O. Wells, etc.

The American Stamping and Machine Company, Chicago, Ill., has been incorporated to manufacture metal specialties and machinery. Capital, $100,000. Incorporators, Geo. T. Eckart, Wm. Brown, John Jurchik.

The Variable Power Gas Engine Company, New York, has been incorporated to manufacture machinery, etc. Capital, $50,000. Incorporators, Alessandro Bolognesi, Aldo Bolognesi, Alfredo Bolognesi, 50 Wall street.

The Cuyahoga Manufacturing Company, Cleveland, Ohio, has been incorporated to manufacture automobiles, carriages, bicycles, etc. Capital, $10,000. Incorporators, Wm. F. Bonnell, J. E. Rawson, E. A. Farrell, etc.

Lord & Burnham, The Rookery, Chicago, Ill., builders, etc., have had plans prepared for a plant at Des Moines, to consist of iron-working shop, woodworking shop, engine and boiler house. Later foundry will be erected.

The Lake Erie Manufacturing Company, Cleveland, Ohio, has been incorporated to do a general manufacturing and machine business. Capital, $25,000. Incorporators, W. E. Mathews, L. J. Nittinger, N. W. Thomas, etc.

The National Screen and Manufacturing Company, Cincinnati, Ohio, has been incorporated to manufacture wooden and metal fly screens, cabinets, etc. Capital, $15,000. Incorporators, S. Abel, Frederick Basken, Chas. Tifer, etc.

The Culver Taylor Chain Company, Detroit, Mich., recently incorporated for the purpose of manufacturing wheel, sprocket and transmission chains, has opened a tool room and is in the market for punch presses, screw machines and oil-hardening furnaces. Address is 14 Madison avenue.

SOUTHERN STATES

The plant of the Davis-Price Foundry and Machine Company, New Cumberland, W. Va., was burned. Loss, $30,000.

The R. J. Reynolds Tobacco Company, Winston-Salem, N. C., has awarded contract for the erection of a machine shop.

The Hauser Manufacturing Company, 644 East Jefferson street, Louisville, Ky., recently organized, will establish a plant for manufacturing brass goods.

The American Manufacturing Company, Chattanooga, Tenn., will rebuild its plant recently burned. Will need machinery for the manufacture of hardware specialties.

The E. B. Lyon Motor Car Company, Durham, N. C., was incorporated to manufacture automobiles and airships. Capital, $50,000. Incorporators, E. B. Lyon, Jas. M. Black, J. E. Johnson.

The Thomas Grate Bar Company has been incorporated with $1,000,000 capital at Valdosta, Ga., to manufacture the Thomas elliptical grate bar under patents of E. L. Thomas, foundryman of that city. The company will also establish branch plants.

WEST OF THE MISSISSIPPI

Edwin Halseth, of Clearbrook, Minn., is erecting a blacksmith shop.

Kugler & Porth are rebuilding their blacksmith shop at Fergus Falls, Minn.

McLin & Savage will enlarge their blacksmith shop at Brisbane via Carson, N. D.

The Pacific Hardware and Steel Company, Portland, Ore., is erecting a new $275,000 plant.

The American Automobile Company, of Beatrice, Neb., will establish a factory at Kansas City, Mo.

The Watertown (S. D.) Steel Tank and Metal Culvert Company is seeking site on which to locate a plant.

The Seattle (Wash.) Car Manufacturing Company, whose forge and machine shop recently burned, is erecting a new building.

T. P. Fay, of the Jones Iron Company, St. Louis, Mo., is said to be contemplating the establishment of an iron foundry at Dallas, Tex.

The Imperial Iron Works, Duluth, Minn., is considering the erection of a new plant at Polk street and Fifty-second avenue, Duluth, Minn.

The R. C. Lynn Machine and Foundry Company, Inooza City, Miss., will move to Graham, Tex., where a new plant is being erected.

The Weld County Automobile Company, with D. R. McArthur as president, will establish a shop at Greeley, Colo., to do general automobile repair work and deal in automobiles.

The Elmore Company, Lincoln, Neb., has started the construction of a modern plant, which will have an output of over 20,000 cars per year.

The Imperial Heater Company, Commerce building, Kansas City, Mo., recently incorporated, will install machinery for the manufacture of heaters. W. Z. Flannery is president.

The United Well Works, Stuttgart, Ark., has been incorporated with $50,000 capital. Has acquired the Stuttgart Machine Works and will combine with J. L. Tindall Machine Company and Sickel & Pennington. Irrigation pumps will be manufactured. New machinery will be purchased, including bending roll, power punch, pipe-cutting and threading machines, cold cutoff saw.

CANADA

The Canada Steel Company will build a $400,000 plant at Hamilton, Ont.

GENERAL MANUFACTURING

NEW ENGLAND

The Providence (R. I.) Brewing Company is enlarging its plant.

Moody & Almon, Waterbury, Vt., are enlarging their power plant.

The box factory of Stratton Brothers, Athol, Mass., was burned.

Paul W. Thayer, Antrim, N. H., is in the market for a waterwheel.

The Burlington (Vt.) Traction Company will purchase waterwheels.

The Colby Academy, New London, N. H., will install a power plant.

William Appleton, Providence, R. I., will build a one-story boiler house.

C. M. Boright, Richford, Vt., will install two 500-horsepower waterwheels.

The Cudahy Packing Company will erect a packing plant in Holyoke, Mass.

The Happy Hollow Woolen Mill, at Uxbridge, Mass., was destroyed by fire.

Albert J. Barber, Woonsocket, R. I., will buy a 10-horsepower vertical boiler.

The town of Amesbury, Mass., will install a 1,000,000-gallon triplex power pump.

The Royal Linen Mills, Mystic, Conn., will equip its plant with an electric motor.

The Lewiston (Me.) Bleachery and Dye Works will erect additions to its plant.

The Wachusett Thread Company, Worcester, Mass., will erect an additional plant.

The M. I. Smith Company, Bristol, Conn., will erect a new factory and power house.

L. S. Ross, Newtonville, Mass., will buy two steam jacket kettles of 100-gallon capacity.

The factory of the Spring Hill Tanning Company, at Woburn, Mass., was destroyed by fire.

C. A. Eaton & Co., Center street, Brockton, Mass., are in the market for boiler-feed and fire pumps.

The Morley Button Manufacturing Company, Portsmouth, N. H., is making an addition to its factory.

A hydroelectric plant is to be built at Bonny Eagle, Me., by the Consolidated Light Company of Maine.

The Pillsbury Baldwin Company, St. Johnsbury, Vt., is in the market for a 100-horsepower steam engine.

The Perkins Institute and Massachusetts School for the Blind, Watertown, Mass., are in the market for a boiler.

The New Britain (Conn.) Machine Company has plans prepared for a new power house and new office building.

The North Reading State Sanatorium, North Wilmington, Mass., is anticipating the installation of a refrigerating plant. Edward W. Perry is master mechanic.

MIDDLE STATES

A. D. Austin's sawmill at Salisbury Center, N. Y., was burned.

The Antigo (Wis.) Lumber Company will erect a new modern sawmill.

The ice plant of the Reedsburg (Wis.) Creamery Company was burned.

The Bristol (Penn.) Patent Leather Company is building an addition.

The MacAndrews-Forbes Company will erect a boxboard plant in Camden, N. J.

The Mitchell Lewis Motor Company, Racine, Wis., will build a new boiler house.

The Davis Laundry Company, Cleveland, Ohio, will erect a three-story addition.

The U. S. Aluminum Company, Massena, N. Y., is building another power plant.

The Malone (N. Y.) Light and Power Company is enlarging and improving its plant.

The Regal Laundry Company, Baltimore, Md., will install a new boiler and engine.

The plant of the Zanesville (Ohio) Barrel Company was destroyed by fire. Loss, $15,000.

The Troy (Ohio) Wagon Works contemplates the erection of a three-story addition.

A $30,000 filtration plant will be built at the Rock Island Arsenal, Rhode Island, Ill.

The sash, door and box factory of Michael Bruneau, Granby, Que., was destroyed by fire.

The Shanghnessy Knitting Company, Watertown, N. Y., will erect a new three-story mill.

The McWillan Woolen Company, Malone, N. Y., has commenced the erection of a new mill.

The F. N. Burt Company, Buffalo, N. Y., is erecting a $75,000 addition to its paper-box factory.

The sawmill of the Sagola (Mich.) Lumber Company was destroyed by fire. Loss, $60,000.

Grundy & Co., Bristol, Penn., manufacturing worsted yarns, is erecting a five-story addition.

The Defiance (Ohio) Suit Case Company is having a new factory erected at East Defiance.

The Silver Manufacturing Company, of Salem, Ohio, is to erect a silo factory in Des Moines, Iowa.

Fire destroyed the plant of the Waverly Paper Box Board Company, Newark, N. J. Loss, $75,000.

The plant of the Pooley Furniture Company, Philadelphia, Penn., was burned. Loss, about $100,000.

Johnson Brothers, of Marshfield, Wis., are contemplating the erection of a glove factory at Wausau, Wis.

The Root Glass Company, of Terre Haute, Ind., has purchased site at Greencastle, Ind., for a new plant.

tained of W. W. Young, consultng engineer, 220 Broadway, New York, and Drexel building, Philadelphia.

The Cleveland (Ohio) Worsted Mills Company has had plans prepared for an addition to its boiler room.

Andrea & Sons, Milwaukee, Wis., manufacturers of electrical supplies, have purchased site for a new plant.

The William Wirtz Company, 132 Union street, Newark, N. J., is erecting a bottling plant on Jelliff avenue.

The planing mill of the Lake Independence Lumber Company, Big Bay, Mich., was burned. Loss, $25,000.

The Diamond Clay Company will erect a plant at Clayton, Ohio, for the manufacture of building and paving brick.

Two creameries will be erected on property of Frank Spencer and McNaughton Milling Company, Fort Covington, N. Y.

The grain elevator, storage house and power plant of the Ogdensburg (N. Y.) Terminal Company, were destroyed by fire.

Fire damaged machinery in the crushing mill at the plant of the Hastings Pavement Company, Hastings-on-Hudson, N. Y.

Electrical equipment for the new plant of the Simonds Manufacturing Company, at Lockport, N. Y., is now being purchased.

The Michigan Grey Iron Casting Company, Detroit, Mich., has taken out a permit for the construction of a one-story core room.

F. G. Bills, of Chicago, Ill., representing a foreign syndicate is looking for a site at Madison, Wis., to erect a $1,000,000 brewery.

The I. B. Kleinert Rubber Company is contemplating the erection of a new factory building on its property at College Point, N. Y.

Louis T. Weiss, mechanical engineer, 286 Taaffe place, Brooklyn, N. Y., is open for bids on small drawn machine-steel shapes, grooved, in carload lots.

The Pikesville Dairy Company, Baltimore, Md., will increase the capacity of its power plant. New boiler will be installed as well as a new ice machine.

Bids will be received until October 19, by the borough clerk, of Allentown, N. J., for construction of a municipal electric-lighting plant. Plans and specifications can be ob-

The Springfield Hospital for Insane, Sykesville, Md., is having plans prepared for a central power house and heating plant to cost $75,000. Dr. J. Clement Clark is superintendent.

The Berwyn Sash and Door Company, Chicago, Ill., has been incorporated to manufacture sash, doors, interior work. Capital, $10,000. Incorporators, Jas. A. Shortall, Thos. F. and William G. Shortall.

Proposals will be received until 10 a.m., October 10, at the Frankford Arsenal, Philadelphia, Penn., for alteration and extension of boiler plant. Full information can be obtained of the commanding officer.

It is reported that the H. W. Johns-Manville Company, which recently acquired the United Indurated Fibre Company, at Lockport, N. Y., has planned the erection of additional buildings at its plant to cost $300,000.

The Isthmian Canal Commission, Washington, D. C., will receive bids until 10:30 a.m., October 27, for washer cutting machine, portable electric grinder, taps, reamers, twist drills, chucks, punches, dies, etc., as per Circular No. 608.

The Phœnix Ceramic Works, a new concern, will erect a plant on the Lehigh Valley Railroad, between Fords and Metuchen, N. J., for the manufacture of porcelain stationary tubs and electrical goods. J. J. Bram, of Perth Amboy, will be manager.

The Indianapolis (Ind.) Gas Company has secured a permit for the installation of two new boilers equipped with automatic stokers at the Lansdale avenue plant. The company contemplates equipping the remainder of its boilers with automatic stokers.

SOUTHERN STATES

The Morgantown (W. Va.) Ice Company will enlarge its plant.

The city of Patterson, La., will issue $30,000 bonds for waterworks.

The Florence (Ala.) Wagon Works will establish a plant at Pensacola, Fla.

It is reported the Montgomery (Ala.) Traction Company will erect a power house.

The Sand Mountain Electric Company, Albertville, Ala., will install new machinery.

The Standard Oil Company proposes to erect a $500,000 plant in West Louisville, Ky.

The city of Walhalla, S. C., will install waterwheel, generator, etc. Geo. L. Wilson, mayor.

City of Portsmouth, Va., will vote on bonds for waterworks. V. O. Cassell, Jr., city engineer.

The city council, Owensboro, Ky., has appropriated $20,000 for water-softening plant at its waterworks.

The Crystal Glass Company, Morgantown, W. Va., a new concern, has let contract for the erection of a plant.

The Richmond & Henrico Railway has secured a permit for the erection of a power house on Lester street, Richmond, Va.

The Blue Ridge Power Company has been incorporated at Gainesville, Ga., with $50,000 capital by Wm. A. Carlisle and others, to build a plant on the Chattahoochee river.

WEST OF THE MISSISSIPPI

Waterville, Wash., will construct waterworks.

Hearne, Tex., is considering the construction of waterworks.

The Globe Lumber Mill, at Globe, Wash., was destroyed by fire.

Exeter, Mo., is considering the installation of a waterworks system.

Enid, Okla., will make extensive improvements to its waterworks.

The town council, Dawson, Tex., has voted $8000 bonds for waterworks.

Chanute, Kan., has voted $75,000 for extension of waterworks system.

Alhambra, Cal., has voted in favor of a municipal electric-light plant.

The Greenville (Tex.) Railway Company will build an electric power plant.

San Augustine, Tex., will vote on issuance of $25,000 bonds fos waterworks.

Hobart, Okla., contemplates issuing $15,000 bonds for improving waterworks.

Nedrow & Ewing are building a cement block factory at Hartington, Neb.

The City Feed Mills, San Bernardino, Cal., is building an addition to its plant.

Grand Island, Neb., will construct waterworks system to cost about $100,000.

The city of Ontario, Cal., will install a pumping plant to cost about $15,000.

The Farmers Union, Tulare, Cal., will erect a modern packing house in Los Angeles.

J. S. Drake has commenced the erection of an ice-cream factory at Hinckley, Minn.

The Polar Wave Ice and Fuel Company, St. Louis, Mo., will erect a cold-storage plant.

Flour mill of Bernard & Staley, Belle Fourche, S. D., was burned. Loss, $65,000.

Contractor Rhode is erecting an addition to his sash and frame factory at Sheldon, N. D.

A flour mill will be erected on Broadway and Green streets, Pasadena, by J. G. Engelburg.

The city of Belton, Tex., will vote on issuance of $14,000 bonds for waterworks system.

The planing mill of Reynolds Brothers, Pittsburg, Tex., was destroyed by fire. Loss, $20,000.

The Cloquet (Minn.) Electrical Company is installing new machinery in its light and power plant.

The Stephens (Ark.) Canning and Manufacturing Company will install an electric-light plant.

The cit yof Belton, Tex., will vote on issuing $11,000 bonds for improving its waterworks system.

The Yellowstone Portland Cement Company, of Gardiner, Mont., has plans for the erection of a cement mill.

J. T. Cameron has been granted a permit by the city council, El Paso, Tex., to erect a $250,000 packing house.

The Consolidated Power and Light Company, Deadwood, S. D., will build a $40,000 addition for a transformer house.

The Gregory Packing Company, Cucamonga, Cal., will erect a packing house near the Santa Fe Tracks, Los Angeles, Cal.

The Grand Show Case Company, of Minneapolis, will erect a factory building at 1200 East Lake street, Minneapolis, Minn.

Power-plant equipment will be required in the new $30,000 hotel to be erected at Redondo Beach, Cal., by W. M. Browning and Jas. A. Johnston.

E. H. Stanton, of the E. H. Stanton Packing Company, Spokane, Wash., will erect two tanneries for tanning by an electrical process at Spokane, Wash.

The city of Redlands and the city of San Bernardino, Cal., are contemplating the erection of a municipal lighting plant to serve both cities jointly.

Equipment will be required for the new building of the Los Angeles Athletic Club, Los Angeles, Cal. The basement will contain a complete power plant.

The Tri-City Railway Company, Davenport, Iowa, will float a $2,000,000 bond issue and improve system, including construction of a $2,000,000 interurban road.

The Northwest Wheel and Wagon Company, Bellingham, Wash., has taken out a permit for the erection of a factory building at Moore and Connecticut streets.

The North Washington Power and Reduction Company will shortly commence the construction of the first unit of a 1000-ton cyanide plant at Republic, Wash.

The Mexican Oil and Asphalt Company, with offices at Los Angeles, Cal., will erect a plant for the manufacture of asphalt near Tampico, Mexico. It will cost $75,000.

The Hubbard Manufacturing Company, Texarkana, Ark., has been incorporated to manufacture barrel hoops, boxes, crates, etc. Incorporators, G. W. Hubbard, Gus Ney, J. R. Thompson.

The North Iowa Brick and Tile Company, of Mason City, Iowa, is planning the erection of a brick and tile plant at Belle Plaine, Iowa. G. W. Howland, Mason City, is in charge. Cost, $200,000.

CANADA

Rouleau (Sask.) will install a waterworks system.

Business Items

The Rockwell Furnace Company, New York, announce the opening of a branch office in the Fisher building, Chicago, Ill., to facilitate business dealings in the Middle West.

Chas. A. Schieren Company, New York, has been awarded the Grand Prix at the Brussels Exposition. Its exhibit consisted of a large pavilion in which there were eight belts running on different drives under different conditions.

The Triumph Electric Company, Cincinnati, Ohio, announces that W. R. Bonham succeeds F. L. Merrill as manager of its Chicago office, and is located at 275 La Salle street, instead of in the Manhattan building, as formerly.

Owing to the continued and rapid growth of its plant, the S. W. Card Manufacturing Company, Mansfield, Mass., makers of taps, dies and screw plates, has had to increase its capacity again. It is erecting a large brick addition to its works, of the latest mill construction, four stories. When completed this will almost double its facilities and enable it to make prompt deliveries.

The National Association of Manufacturers has removed its general offices from 170 Broadway to 30 Church street, one of the twin Hudson Terminal buildings. The association's growth during the past few years necessitated more commodious quarters than could be obtained at the Broadway address.

Forthcoming Meetings

International aviation meet, Belmont Park, Long Island, October 22 to 30. Auspices of the Aëro Club of America, 29 West Thirty-ninth street, New York City.

National Machine Tool Builders' Association, annual meeting, October 25-26, Hotel Astor, New York. Chas. E. Hildreth, secretary, Worcester, Mass.

National Society for Promotion of Industrial Education, fourth annual convention, Boston, Mass., November 17, 18 and 19.

American Society of Mechanical Engineers, annual meeting, December 6-9, New York. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care, 505 Pearl street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

Test indicators. H. A. Lowe, Cleveland, O.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

The "Gas Saver" brazing forge; circular. J. L. Lucas & Son, 2 Fox St., Bridgeport, Ct.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Wanted—Medium weight specialties or contract work. Wm. A. Cather, Pottsville, Penn.

Machinery to order, or will purchase good patents. Interstate Machinery Co., Troy, N. Y.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Let us be your factory; anything in metal; small work a specialty. P. O. Box 284, Anderson, Ind.

If you want special machinery or tools designed, I can give you satisfactory service. Box 39, AMERICAN MACHINIST.

Wanted—Catalogs and all information on machinery for file and saw manufacturing. Box 46, AMERICAN MACHINIST.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Wanted—One second-hand boring and turning mill in first-class condition; 60-inch swing, two heads on cross rail. Box 21, AM. MACH.

Machinery and manufacturing plants, designed, constructed, examined and reported on. A. W. Jacobi, Engineer, 192 Market St.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Notice—We have a large capacity and exceptional facilities for manufacturing, that involves sheet metal, brass foundry and electroplating work; will manufacture on royalty or other equitable basis. Address The Conneaut Company, Conneaut, Ohio.

Those breaks on power plant or machinery! Are you going to lose time awaiting new parts from makers, or will you let us weld them at one-fourth to three-eighths cost of replacements? Re-shipment within 24 hours. Oxy-acetylene process, producing homogeneous weld of cast iron. No charge unless successful. Waterbury Welding Works, Waterbury, Conn.

Wanted—Partner with twenty-five thousand dollars or machine shop and some cash against advertiser's five thousand and inventions to manufacture line of machinery paying fifty per cent. profit; advertiser now receiving five thousand yearly as manager in same line, in which he has had twenty-four years' experience as apprentice, machinist, patternmaker, draftsman, designer, salesman, salesmanager; designs for four machines completed; would consider buying small modern machine shop on easy terms, preferably in the East. Address "B. C.," AMER. MACH.

Help Wanted

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

We want representatives in territory named below to handle as a side line on a liberal commission basis, a well-advertised and quick selling line of lathe tools; commissions given on all orders and reorders received from prescribed territory; first-class side line for salesmen calling on machinery and other manufacturing trade; we have for immediate allotment States of Rhode Island, New Jersey, Indiana, Michigan, Maine, Minnesota and Wisconsin; choice sections in the States of New York, Massachusetts, Pennsylvania, Ohio and Illinois, and some other good territory not mentioned; send your references with reply. Address at once, "R. T.," AMERICAN MACHINIST.

DISTRICT OF COLUMBIA

United States Navy wants machinists; pay $44 to $77 per month, clear of living expenses, with splendid chance for promotion to warrant machinist at $1200 to $2100 per year; the life is healthy and different forms of athletics are encouraged; the food is wholesome and plentiful, and the opportunity to save money and see some of the United States and foreign countries is excellent. Send for free illustrated booklet which tells all about navy pay, play, promotion, etc. Address Bureau of Navigation, Navy Department, Washington, D. C.

INDIANA

Wanted—First-class toolsmith. The Western Motor Co., Logansport, Indiana.

Wanted—Four operators for Gleason bevel gear generators; four operators for Bilgram bevel gear generators; six operators for Brown & Sharpe automatic spur gear cutters; also one man capable of producing results that has had experience in all gear cutting lines, that would be capable of taking charge of large gear cutting department; none but first-class men need apply. 423 Johnson Block, Muncie, Ind.

MASSACHUSETTS

Wanted—High-grade designing draftsman with large experience in steam engineering practice for permanent position with a large manufacturing concern in Massachusetts. State age, education, experience and salary expected by addressing Chief Draftsman, Box 950, AMERICAN MACHINIST.

Wanted—A thorough, capable and experienced mechanic to take charge of manufacturing a line of milling cutters and small tools; ability to design cutters and answer correspondence very essential; must be a hustler with a thorough knowledge of the opera-

tion of modern machine tools and a good producer in quantity of high grade work; for consideration apply confidentially, giving age, nationality, education and salary expected. Box 28, AMERICAN MACHINIST.

MICHIGAN

Salesman to solicit special screw machine products as side line, liberal commission to competent man. Address Michigan Products Co., Grand Rapids, Mich.

Wanted—Salesman experienced in selling machine tools, milling cutters and small tools; state experience and qualifications fully; specify age and compensation required; must actually be employed in a similar line and a hustler with A-1 recommendations; location, Middle West; applications treated strictly confidential. Box 27, AMERICAN MACHINIST.

NEW JERSEY

Automatic screw machine operator; state salary and experience. Box 24, AM. MACH.

Wanted—Salesman familiar with the sale and manufacture of some good special line of machinery capable of profitable development for a modern plant. Address "Practical," AMERICAN MACHINIST.

Good, active young man as machine shop foreman in a small growing shop; must be up on shop practice and capable of handling men. Address, giving full particulars, Box X Y Z, AMERICAN MACHINIST.

Wanted—Mechanical engineer, familiar with some good line of machinery which could be taken up and developed by a well equipped foundry and machine shop. Address with particulars, "Reliable," AMERICAN MACHINIST.

NEW YORK

Toolmakers Wanted—Large firm will pay 45c. per hour to first-class men; give age, experience and reference. Box 30, AM. MA.

Thoroughly experienced draftsmen on gas and oil engine work; state age, nationality, training, full details, last 5 years' work with salaries received. Box 11, AMER. MACHINIST.

Wanted—Toolmakers, first class on model and special automatic machine work; good pay and steady work to competent men; give age, experience and reference; vicinity of New York City. Box 978, AMERICAN MACHINIST.

Wanted—Foreman for machine tool department, about 50 hands, steam and gas engine factory; applicants must be thoroughly experienced in handling men and equipment; state age, experience and references. Box 15, AMERICAN MACHINIST.

A-1 stenographer and graphophone operator, capable of taking semi-technical dictation and transcribing rapidly and accurately from notes and phonograph; also writing letters without dictation; state age, experience and salary expected. Box 20, AMER. MACHINIST.

Wanted—Assistant superintendent wanted for automobile factory; must have practical knowledge of machinery, be a hustler and good producer in quantity of high-grade work; give full information as to experience, etc.; applications treated strictly confidential. Box 31, AMERICAN MACHINIST.

Wanted—Salesman experienced in machinery or electrical lines to sell new line of portable electric tools on liberal commission basis; will allow definite territory to the man who will really work it; we know what can be done with this line and want a hustler to do it. Box 946, AMERICAN MACHINIST.

Wanted—Mechanical superintendent, first-class practical man able to design tools, fixtures, develop special small machinery; must be well educated, ambitious, have executive ability; only high-grade men need apply; state full particulars, salary expected, etc., in first letter. Box 37, AMERICAN MACHINIST.

OHIO

Superintendent for general machine shop with kindred branches; must be familiar with modern methods, systems and shop accounting; technically educated preferred; give full particulars first letter. Box 998, AM. MACH.

Wanted—A thorough, capable and experienced mechanic to take charge of manufacturing a line of milling cutters and small tools; ability to design cutters and answer correspondence very essential; must be a hustler with a thorough knowledge of the operation of modern machine tools and a good producer in quantity of high grade work; for consideration apply confidentially, giving age, nationality, education and salary expected. Box 29, AMERICAN MACHINIST.

Wanted—First-class machinists, toolmakers die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood patternmakers, brass molders, polishers, buffers, finishers, spinners, millwrights, hammermen and blacksmiths who are seeking positions or desirous of improving on those which they have, to register their names and addresses with the free Employment Department of the National Metal Trades Association. Address Commissioner's Office, 605 New England Bldg., Cleveland, O.

PENNSYLVANIA

Wanted—Floor hands and fitters on machine tool work. Colburn Machine Tool Co., Franklin, Penn.

Wanted—Lathe, boring mill and floor hands for day and night work. Address the Jeanesville Iron Works Company, Hazleton, Penn.

Wanted—First-class foreman to take charge of assembling; must have had a satisfactory record as foreman; will pay $125 per month. Box 953, AMERICAN MACHINIST.

Wanted—First-class man as inspector; one with some automobile experience preferred; first-class position for man who can come well recommended. Box 954, AMER. MACH.

Wanted—Skilled mechanic capable of constructing by hand, experimental models of delicate electrical instruments and meters; must have served full apprenticeship and be well experienced; good position for proper party; state experience and salary expected when answering. Box 18, AMER. MACHINIST.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

WISCONSIN

Wanted—Draftsman, bright young man to take charge of a small drafting room. Address "A. Z.," AMERICAN MACHINIST.

Foreman wanted for monitor department; must be strictly first class in every respect, none other need apply; steady work and good pay for the right man. Address Box 934, AMERICAN MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

Superintendent or factory manager, thoroughly conversant with modern methods in manufacturing light or medium interchangeable work; twelve years' executive experience. Box 41, AMERICAN MACHINIST.

GEORGIA

Machine shop foreman desires change; good references. Box 32, AMERICAN MACHINIST.

ILLINOIS

Wanted—Position as superintendent or assistant, thoroughly conversant with piecework and uptodate methods of manufacture of interchangeable work; have had 18 years of general shop practice; A-1 organizer. Box 26, AMERICAN MACHINIST.

MASSACHUSETTS

Position as assistant superintendent or chief draftsman; age 28; twelve years' experience as shop apprentice, inspector, tester and designer of automatic machinery; can handle men and get results. Box 35, AM. M.

Factory manager, successful, experienced in organization, cost and factory systems, desires change; can produce results and stand on own record, and give best references from present and past employers, also satisfactory reason for changing. Box 9, AMERICAN MACHINIST.

NEW JERSEY

Tool designer experienced on jigs, fixtures, etc., for small manufacturing, desires change. Box 44, AMERICAN MACHINIST.

Middle-aged man with experience, purchasing costs, bookkeeping and executive, with knowledge of drafting in machine shop and foundry. Box 16, AMERICAN MACHINIST.

Foreman, practical and technical experience; handle milling, drilling, screw machine department or tool room; thorough mechanic; good executive, desires change. Box 45, AMERICAN MACHINIST.

Mechanical superintendent, practical, technical, has risen to position on merit; an executive versed in details as well as general principles; successful record as organizer, cost reducer and originator of improved methods and machinery; will change if position open will permit full use of ability and past experience. Box 43, AMERICAN MACHINIST.

NEW YORK

Mechanical engineer, 12 years' experience along broad lines, is open for engagement. Box 22, AMERICAN MACHINIST.

Draftsman with long experience in machinery and mill work, wishes position; New York or vicinity. Box 981, AMER. MACHINIST.

Designer wishes situation in New York; executive ability; 14 years' experience in designing automatic machines. Box 36, AM. M.

Mechanical and structural draftsman, ten years' shop and office experience, technical graduate, desires position, New York vicinity. Box 25, AMERICAN MACHINIST.

Any firm wishing to make their own die molded castings can obtain the services of a man who is thoroughly posted by addressing Box 34, AMERICAN MACHINIST.

Production engineer with twelve years' manufacturing and commercial experience in responsible positions, desires position as manager or superintendent. Box 40, AM. MACH.

Foreman, middle aged, now employed, latest methods, engineering, dynamos, electrical and general machinery; A-1 hustler; can handle force with executive ability. Box 33, AM. M.

Mechanical superintendent of a large manufacturing plant, with twenty years' experience in general machine and foundry practice, desires making a change. Box 901, AMERICAN MACHINIST.

Ambitious young man, 24 years of age, desires position in the cost department of a concern that affords an opportunity for advancement; have had six years' office, accounting and factory cost experience. "I. R.," Box 17, AMERICAN MACHINIST.

Sheet metal superintendent and factory manager desires change; vicinity New York; expert in steel, brass and metal stampings every description; uptodate tools, dies and special devices for same; capable executive; fully competent. Box 974, AMER. MACHINIST.

A-1 practical man, 33, with technical education, desires change, as designer of tools, labor-saving devices, developing special experimental machinery; well up in electrical and instrument work; good executive and inventive ability; ten years as head of department and foreman; ambitious, resourceful; best references. Box 42, AMER. MACHINIST.

PENNSYLVANIA

Tool and model making foreman with good executive ability, at present engaged as such, desires change; age 32. Box 38, AM. MACH.

RHODE ISLAND

Position by an expert mechanic as foreman, tool or machine room; 21 years' experience as machinist, draftsman and designer, toolmaker, foreman, etc., on highest grade interchangeable work. Box 19, AMER. MACH.

WISCONSIN

High-grade designer of special automatic machinery wants position offering good prospects; inventive ability; good mechanic and executive; developing and perfecting machinery a specialty; at present in charge. Box 999, AMERICAN MACHINIST.

FOR SALE

For Sale—National six-spindle nut taper, all-geared drive; also one Waterbury rivet spinning machine. McCabe Mfg. Co., 425 West 25th St., New York.

For Sale—Very reasonable, almost new, boring bars: 8"x10', 6½"x9' 6", 3½"x4' 2", 2½"x3' 8½", with steam engine and complete set of patterns for casting of bars; can be seen at Hoboken, N. J. Address "Bargain," Care AMERICAN MACHINIST.

For Sale—One 3x36 Jones & Lamson; this machine is of late type, full turret, shifting hob, complete with full set of chucking and bar equipment. Wanted—A medium size plain milling machine; also 24-inch drill press; will buy, sell or trade. Quride Co., Syracuse, N. Y.

An opportunity to start a machine shop; we offer one of our departments for sale, the one used to establish our business; it is small and profitable work, but as we are devoting ourselves to heavier work, we offer to sell for $2000, all the drawings, patterns, and stock of finished and partly finished parts and rough material (inventories over $3000), circulars, electrotypes, special machinery and fixtures, and an established trade. Address Sipp Machine Company, Paterson, N. J.

Atlas Engine Works, Indianapolis, Indiana, offer for sale, surplus machine shop and boiler shop equipment: 52-inch Betts car wheel boring machine, with air crane attached, side head for facing, late design, heavy pattern; 48-inch Walcott shaper, with chuck, good as new; 24-inch x 8-foot American turret lathe, used eight months; No. 1½ Beaman & Smith horizontal floor boring, milling and drilling machine, new and standard in every detail; four-motor Morgan electric traveling crane, 49-foot 3-inch span, 220 volts, direct current, main hoist 15 tons, auxiliary hoist five tons, Dinkey controller, General Electric motors, new; planers, shapers, hydraulic wheel presses, radial drills, overhead traveling drills, lathes, cylinder boring machines, vertical boring mills, punches, bending rolls, bevelers, air hoists, flanging machinery—all in unusually good operating condition.

Talks With Our Readers

By the Sales Manager

Here's something we have received from one of our readers. It's so good that we pass it along to you as it is.

* * *

"I haven't been wise to the real advertising game myself very long, but I didn't let on to that when young Osborne (no relation to the oil country) began grumbling about there being so much advertising that there wasn't any room for reading pages. Then I worked my recently acquired knowledge for all it was worth.

"'Getting to be more advertising and less reading every issue, by gosh. I don't see how they get people to give up good money for all that advertising when nobody ever reads it. And—'

"But he didn't get any further, for my righteous indignation began to work overtime and I lit right in without even saying 'excuse me!'

"'Osborne', says I, 'you're just a plain plumb idiot, but thank the Lord there ain't many like you. Less reading pages nothing — can't you count? There's the issue of September 1. Take it and look at it. There's 48 pages of reading, six pages for a measly little cent, counting the Help Wanted ads, and they are mighty handy when a fellow wants a job.

"'But never mind the reading pages; just take a hasty glance over the ads that you are kicking about and see if you can learn anything or whether you know every blooming thing there is there.

"'Bet you never heard of the automatic grinder shown on page 3, even though it has been on the market several years. Probably didn't know that you could grind work to size without measuring it half a dozen times. Or an engine lathe with an 8-in. belt, as on page 4.

"'You were asking me the other day how one of these geared feed boxes worked; you can see for yourself on page 7. Remember the valve bodies we thought we were making such howling good time on last week, and the special brass set screws also? Well, just look on pages 15 and 18 and you'll see we weren't in it for a minute. And that dividing head information you wanted is shown on page 27.

"'If you want some points on time grinding for crank shafts you'll get them on page 75 in full details, and it's mighty handy to have round.

"'There's another pointer on page 89 also. Likewise on page 101 too.

"What do you know about turning tool steel at 220 feet per minute, with a 1|16-in. cut and 3|64-in. feed? See page 192.

"'You remember reading how George H. Corliss used to put his engines into a mill and take his pay in the coal he saved. Well, that's exactly what the Hess-Bright people are doing with their ball-bearing hangers and you'd better bear it in mind before that new extension gets to the shafting stage.

"'Do you know how fast steel bars can be cut off with a good saw these days? You'll get a whiff of knowledge along these lines on page 223 if you look sharp after it.

"'The work picture and the principles evolved on pages 242 and 243 are worth storing away in your think box, to say nothing of the little points you can pick up about drills, disk-grinder work and other things that we have just skimmed over. And you can get a fair little library of useful information from the makers of graphite, hardening material and other things too numerous to mention.'

"I've got so I look over the ads as carefully as I do the rest of the paper and I get a lot of points every time.

"I don't know whether I convinced Osborne or not, but he said perhaps there was something in the ads after all and he'd see if he couldn't get something out of them as well as I did."

* * *

Tell us some of the helpful ways in which you make use of the Selling Section.

* * *

Only reliable products can be continuously advertised.